Woodlands and Wildlife

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Woodlands and Wildlife

Making your property attractive to wildlife

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Woodlands and wildlife

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Quotation from The Pleasures of a Shooting Diary, a chapter in *The Upland Shooting Life* by George Bird Evans, Alfred A. Knopf, NY. 1971. Used courtesy of the author.

"I like the red dogwood because he feeds October robins, and the prickly ash because my woodcock take their daily sunbath under the shelter of his thorns. I like the hazel because his October purple feeds my eye, and because his November catkins feed my deer and grouse. I like the bittersweet because my father did, and because the deer, on the 1st of July of each year, began suddenly to eat the new leaves, and I have learned to predict this event to my guests."

From SAND COUNTY ALMANAC by Aldo Leopold

Like Aldo Leopold, the father of wildlife management, different kinds of wildlife like different things in the forest. By your own action or inaction, by design or by accident, you can provide these things or take them away.

A guide to the contents of this book

Planning for Wildlife on Your Property 11

This section discusses questions to ask and steps to take before jumping into the middle of the book. What are your objectives? What do you have to work with? What are you willing to trade for wildlife? In addition to making your efforts on behalf of wildlife more effective, answers to these questions could help prevent costly mistakes.

Keep a Nature Journal 17

A fun thing to do. If systematically kept, your notes will gauge progress in attracting birds and other animals to places where they can be observed.

Managing Major Forest Habitats 21

If you are looking for several wildlife species rather than a single species, learn how to attract them through judicious combinations of cuttings, plantings, and do-nothing-areas that are designed to enhance vegetative and, consequently, wildlife diversity. Establishing, maintaining, and improving the following major habitats is discussed against a background of their particular values to a variety of wildlife species.

- Herbaceous Openings 22
- Brush 25
- Sapling and Poletimber Stands 27
- Mature Woodlands 28
- Evergreen Cover 29
- Wetlands 30

Forest Wildlife 33

You will find this section useful whether your interest is confined to a particular species, like wild turkeys, or a group of species, like songbirds. Species and groups are treated in terms of their needs for particular kinds and combinations of food and cover, and how you can satisfy these needs.

- White-tailed Deer 33
- Ruffed Grouse 36
- Wild Turkey 38
- Squirrels 40
- Woodcock 41
- Beaver 42

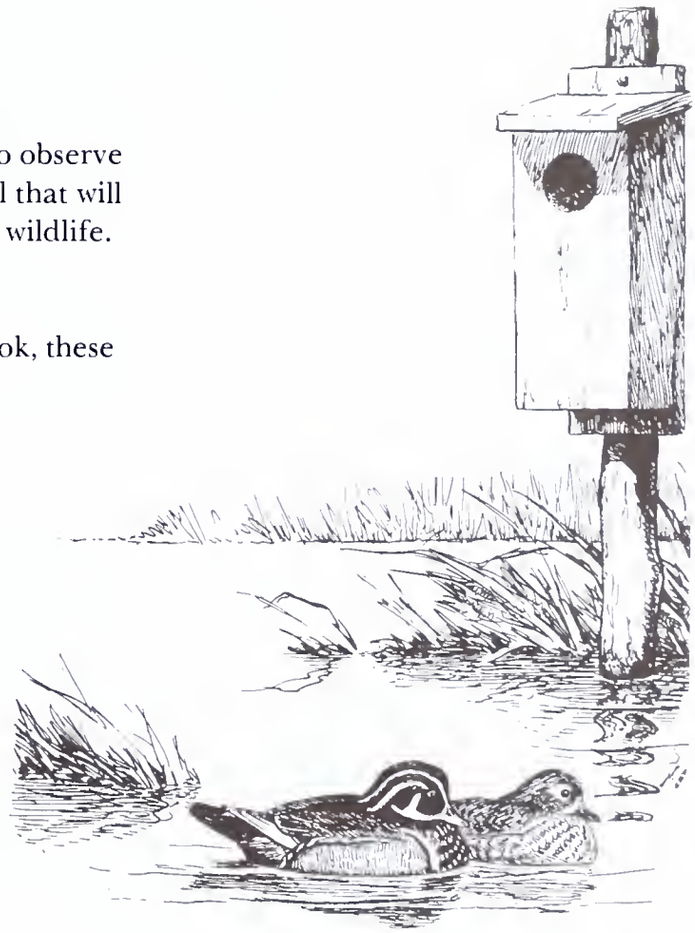
Furbearers 44
Small Mammals 45
Waterfowl 48
Songbirds 51
Hawks and Owls 55

Farm Wildlife and the Forest 57
Most farm wildlife use forest land to satisfy some daily or seasonal needs, especially in winter when most crop fields are barren. When you wish to encourage farm wildlife species to use your property, this section suggests ways and means to do it.

Cottontail Rabbit 57
Ring-necked Pheasant 59
Mourning Dove 60
Bobwhite Quail 61

Trails to Wildlife 63
A well-planned trail permits you to enter wildlife habitat and to observe without intruding. Discover how to lay out and construct a trail that will bring you together with a variety of birds and other forms of wildlife.

Beyond this Primer 65
When your interests lead you beyond the information in this book, these suggestions will provide further details.



Planning for Wildlife on Your Property

A stand of pine trees planted years ago is now a winter haven for a few deer and a pheasant or two. A pair of doves nest in those trees, their cooing a gentle reminder of a chore forgotten. Those pines need thinning. But how to do it without undue disturbance to the wildlife your family enjoys? You hardly want to repeat the incident of last spring when, for the need of some firewood, you cut down a hollow tree that housed a screech owl family. In the early dawn you had seen the parent owls low over your alfalfa looking for field mice. The owls are gone now, but not the field mice.

Your neighbor has ignored his woodlot. A few years ago he was encouraged to sell some trees. He declined, fearing unknown consequences. Like you, he asked, "What will happen to the birds and other animals that I enjoy so much?"

What you decide to do or not to do with the forests and fields on your property offers either pitfalls or possibilities for wildlife. Helping you to avoid the pitfalls and take advantage of the opportunities is the purpose of this book. Whether you are farmer or tenant, absentee landowner or sportsmen's club, this book suggests different things you can do to turn your forest acreage into a more desirable place for wildlife.

There are certain questions to answer and steps to take to make the information work for you, whether your objective is more songbirds at your feeder, fewer squirrels in your corn, or more grouse to challenge your bird dog.

What are your objectives?

Is your wooded acreage bounded by a mosaic of fields, orchards, and utility rights-of-way, or is it a part of a larger forest? The general character of your neighborhood will more or less dictate the kinds of wildlife you can expect to see or attract to your property. Your goals must be realistic. Regardless of the land you own, you can't expect to attract unusual or rare wildlife species. If your property is in mountainous terrain, you may see a bobcat or a wild turkey, but it is unlikely that you will attract these species to a small, isolated woodlot in the midst of extensive farmlands. Wildlife you see in your neighborhood is a clue to what you might expect to visit your woodland. With this background, let's examine two kinds of objectives.

Many landowners opt for an interesting, aesthetically pleasing forest capable of supporting a variety of animals. If this is your objective, your overall thrust must encourage long-range development of a woodland that contains many different kinds, combinations, and contrasting age-classes of trees and other forest growth. In short, if you are looking for a mixed bag of wildlife, then strive for diversity in your plant communities.

Interest in one particular species is a more specific objective. A sportsmen's club, for example, may want to do everything possible to increase the numbers of grouse on its grounds. Measures that club members might use to attain this specific objective are described in the ruffed grouse section.

Application of management prescriptions in this book cannot guarantee that your woodland will support more of a favored species. Factors other than food and cover may limit a population. Conditions conducive to parasitic infection of your favored species, for instance, can frustrate you in achieving your objective to increase its numbers. Some variables, like severe weather, cannot be predicted. Exceptionally wet springs, for example, are detrimental to cottontail reproduction. Pinning your hopes on a single species entails other risks. Small-scale efforts to improve habitat for one species can be offset by more extensive land-use changes in the neighborhood. If you convert an acre of mature trees to brush for grouse while your neighbor converts ten acres of brush to pasture, the net result could be fewer grouse in your woodland. Under these circumstances, successes are masked and consequently interpreted as failures. Creating habitat diversity, where failure to attract one species is offset by success in attracting others, involves relatively less risk.

Whether your objectives are general, specific, or both, this may be a good time to jot them down. Remember, your goals should not invite frustration or unreasonable risks. Be practical; build on what you have rather than trying to start from scratch. This raises another question.

What do you have to work with?

Keep your inventory simple. Don't try to describe every nook and cranny in the forest.

First, list the kinds of wildlife that you have seen in your neighborhood. Refer to the contents page for a convenient listing of wildlife species. Under broad categories such as furbearers, small mammals, waterfowl, songbirds, and hawks and owls, you might want to be more specific. When you complete your list, make notations after each species as to whether it is common (c), an occasional visitor (o), or rare (r). Do certain kinds live on your property year round or only visit it? Some migrating birds appear only seasonally. Notations about where, when, and how many you see of a particular species can be as elaborate or as simple as you want to make them. Whatever your inclination, such a check list is a useful first entry in a nature log.

Second, inventory and map the resources on and adjoining your property including pastures, crop fields, idle fields, orchards, tree plantations, woods, hedges, fencerows, marshes, ponds, streams, utility rights-of-way, roads, and buildings. If your property is small (less than 60 acres), a simple sketch is adequate. An aerial photograph will help if you own a larger property. The aerial photo is a good base map in that it shows

buildings, roads, fields, woodlots, and other features already in place. The U.S. Soil Conservation Service (SCS), with an office in every county, can assist you in purchasing an aerial photograph of your property. The sketch on page 15 is a good example of what to include on a map.

Is your forest composed of different-aged stands, or are all the trees whose tops are exposed to the sun of the same general height? Is there a well-developed layer of low vegetation under the trees? What does this understory look like in winter? Is your forest composed of both evergreens and nut-producing hardwoods? If there are evergreens, could they shelter grouse in the winter? It is important to know whether your woodlot contains too much or too little of a particular food and cover type.

As used here, a *stand* is any group of trees or other forest growth that is sufficiently uniform in appearance so as to be distinguished from adjacent groups. A stand can be numbered or named and represents a convenient work unit.

Now map what you see — the object being to subdivide your woodlot into areas covered by similar vegetation. For example, 9 contiguous acres are covered by deciduous trees whose trunks, when measured 4 feet above the ground, are mainly less than 4 inches in diameter. Draw a line around this 9-acre stand. Also delineate openings, groups of same-aged evergreens, and recently logged areas. Since some stands blend imperceptibly into one another, boundaries need not be precise. Personal choice may dictate that an old fence, creek, logging road, or other distinctive features be used to mark the edge of a work unit.

How the cover types on your property relate to other cover types in your neighborhood is important, particularly if you own a small woodlot. General information about habitats surrounding your forestland can be very useful to your planning since birds and other wild animals do not recognize property boundaries. With a map in hand you can systematically plan what, where, and when to make improvements.

What are you willing to trade for wildlife?

You are not likely to implement your plan for wildlife if unreasonable trade-offs are required.

Perhaps you would like to encourage those wild turkeys in your township to visit your property; if so, a small opening in your woodlot might help. Will you trade the time to create and maintain that opening for a chance to see a gobbler? If you farm, will you trade a few rows of standing corn next to your woodlot for the glimpse of a few deer or a pheasant to brighten a January day? Are you willing to trade some old trees for younger ones with the complement of birds and animals that use low-growth forests?

Trade-offs incur expense either in money, personal time, or resources that could be devoted to something else. Fortunately, there are ways to reduce or circumvent the expense of some trade-offs.

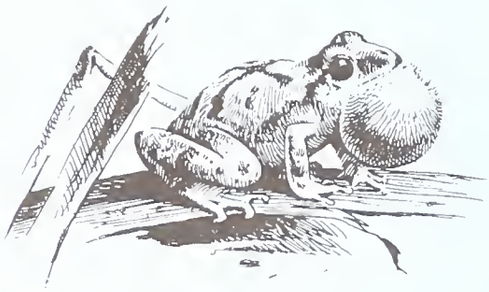
Instead of planting evergreen cover solely for wildlife, consider a tree farm. Evergreens planted for Christmas trees, pulp, or timber will house wildlife between harvests.

Cutting back a forest edge next to a cornfield will attract wildlife. More of your corn will be eaten, but more will grow in response to the extra sunlight.

Why cut browse for deer, create an opening for turkeys, or cut back an

edge at your own expense, if all this can be done by selling mature trees to a local buyer? Trees marked by a reputable forester and cut accordingly will add money to your pocket, wood to the economy, and wildlife to your property.

In brief, be practical. Ask yourself, "What resources do I really have to work with? What areas will or won't I devote to improving habitat for wildlife? Have I really tried to integrate my plans for wildlife into other management activities on my property?" Honest answers to these questions will save you money and time.



Completing Your Plan for Wildlife

You have your objectives, resource base (and map), and capabilities clearly in mind. Now you're ready to look at other sections of this book.

If your property is covered by mature woodlands, turn to that section and learn how to make these woodlands work for wildlife. If your goal is to attract deer and songbirds, thumb to these respective sections for how-to-attract-them techniques.

As you read these or other pertinent sections, certain management options will suggest ideas for locating cuttings and/or plantings on your property. Referring to your inventory map, list the work site numbers, and on another piece of paper describe what, if anything, you plan to do at each site. When a job is completed at a particular site, label it "OK."

Also note any site changes. For example, if you replace your orchard with a grain crop, don't forget to update your inventory and work map.

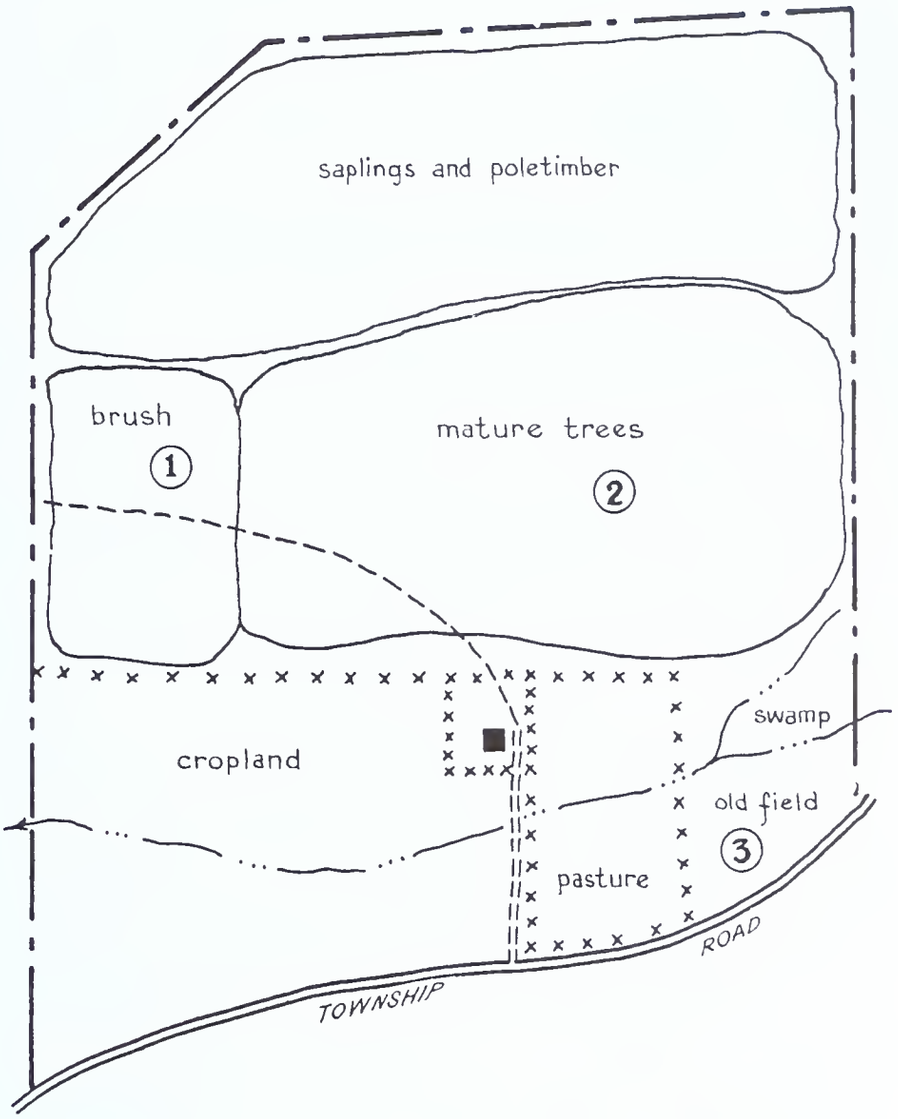
Below is an example of an abbreviated work plan for the 60-acre property illustrated on the map. Your work plan and map are useful records of work intended and work completed. Your wildlife inventory and a regularly kept nature journal can be records of wildlife response to work completed.

WORK PLAN FOR THE PROPERTY OF John Doe

PREPARED ON: October 1, 1985

OBJECTIVES: More songbirds and squirrels

WORK SITE NO.	WORK INTENDED	IDEAS FOR ATTRACTING WILDLIFE SEE BOOKLET PAGES:
1.	Clear brush off 1 acre and plant evergreens.	p.51, songbirds p.29, evergreens
2.	Sell some trees, but with reservation that trees with holes and a mix of older oaks and hickories are left after sale. Consult forester; explain conditions.	p.40, squirrels p.28, mature woodlands
3.	Mow field. Install 10 bluebird boxes around the field and plant six apple trees along edge of swamp.	p.51, songbirds p.22, herbaceous cover



SCALE: 1"=300'
PROPERTY ACREAGE: 60
ACRES IN WOODLAND: 40

LEGEND

- Property Boundary
- Township Road
- Improved Dirt Road
- Unimproved Dirt Road
- Cover Type and Stand Boundary
- (2) Work Area Number
- Stream
- Building
- Fence

COVER TYPE	ESTIMATE ACRES IN COVER TYPE
CROPLAND OR GARDEN	13
GRASS OR PASTURE	4
ORCHARD	
OLD FIELD: more grass, weeds, briars, vines, and small shrubs other than trees.	3
BRUSH: shrubs like hawthorn, sumac, alder, black willow and/or tree seedlings and saplings with most twig ends under 5' high.	6
SAPLINGS AND POLETIMBER: mainly 1-12 inch diameter deciduous trees.	18
MATURE WOODLAND: mainly 12+ inch diameter deciduous trees.	16
PLANTATION: planted evergreens excluding ornamentals.	
HIGH EVERGREENS: without live branches near the ground.	
LOW EVERGREENS: like laurel or young pines, with live branches near or touching the ground.	
OTHER, LIST:	

Keep A Nature Journal

Your journal can be general or it can be designed around special interests like bird watching, or working with a favorite dog. You can make daily entries, as in a diary, or occasional remarks on special days.

George Bird Evans in The Pleasures of a Shooting Diary, pens a compelling argument for writing it down. He reflects in a final paragraph:

". . . . certain days glow like a sifting of golden maple leaves in an old lane in October, moments uncovered as I turn a page spotted with gun oil: a Hunter's Moon viewed through bare branches after a day's shooting; a feathered form laid in my hand and setter eyes that seemed to say, "George, did I do it right?" Mention of a sun disappearing behind a purple ridge as I climbed that last hill to the station wagon with an empty game pocket, bonetired but immeasurably happy. For as long as I have these pages, many of them yellowed and beginning to smell of time, my setters will range the fall and winter woods. And, for just as long, I'll be there."

There are other reasons, too, for keeping a written record of seasons past. Recording what you see can be used as a gauge of your progress in improving your land for wildlife, and it can signal changes in the wildlife composition of your woodland. A log with regular entries can be a valuable historical record.

An oldtimer might tell you that your area used to have a lot of deer, or maybe he remembers an unusually large flock of turkeys. But beyond this kind of casual reflection, do you have access to descriptions of what your woodland was like even a few years ago? This is unfortunate as subtle, perhaps unwanted, changes go unnoticed and unchallenged. Is it enough to mourn the absence of bluebirds without asking why? Did you unknowingly do something to send them packing?

It is interesting and challenging to know what is happening on and near your property. A few field guides to help you identify plants and animals and a notebook will get you started. Good identification guides are commonly available in most bookstores; and a diary or bound notebook can serve as a nature log.

Record the date, weather, and location of your observations. Don't make the mistake of recording only rare or unusual things because common events today may be uncommon ten years from now. Sometimes,

notes about what you don't see can be important. Detailed, regular observations are most valuable. But don't invite frustration by attempting too much.

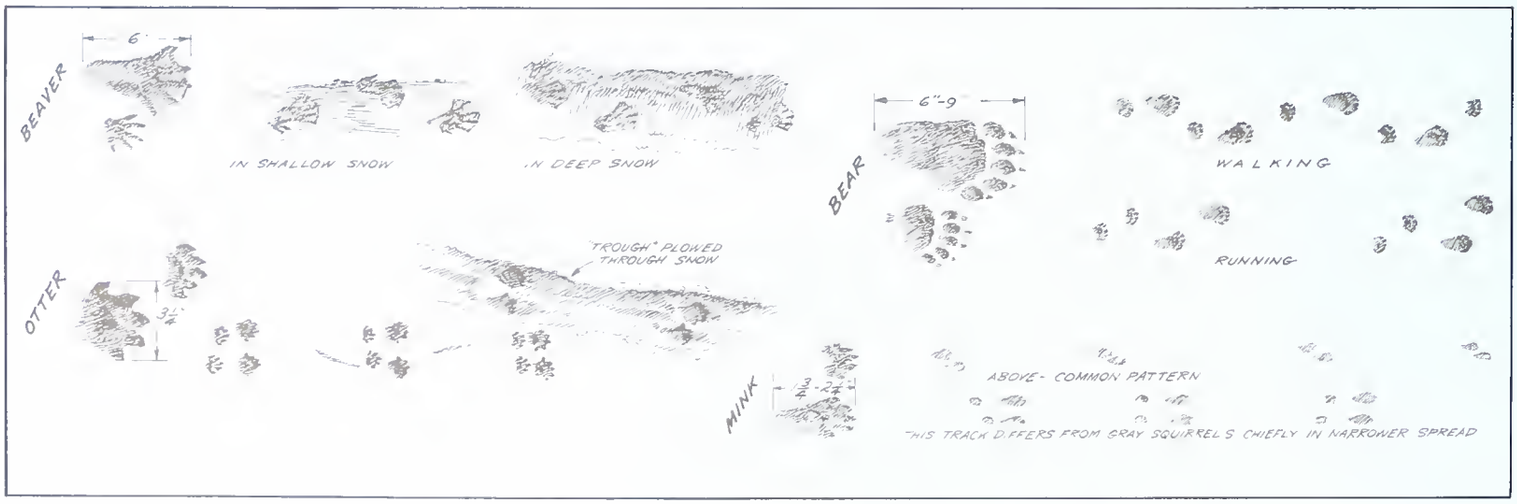
Three fun things to do are to take a census of bird box use, look for tracks in snow, and compile for one day a list of all animal signs you can find on your property.

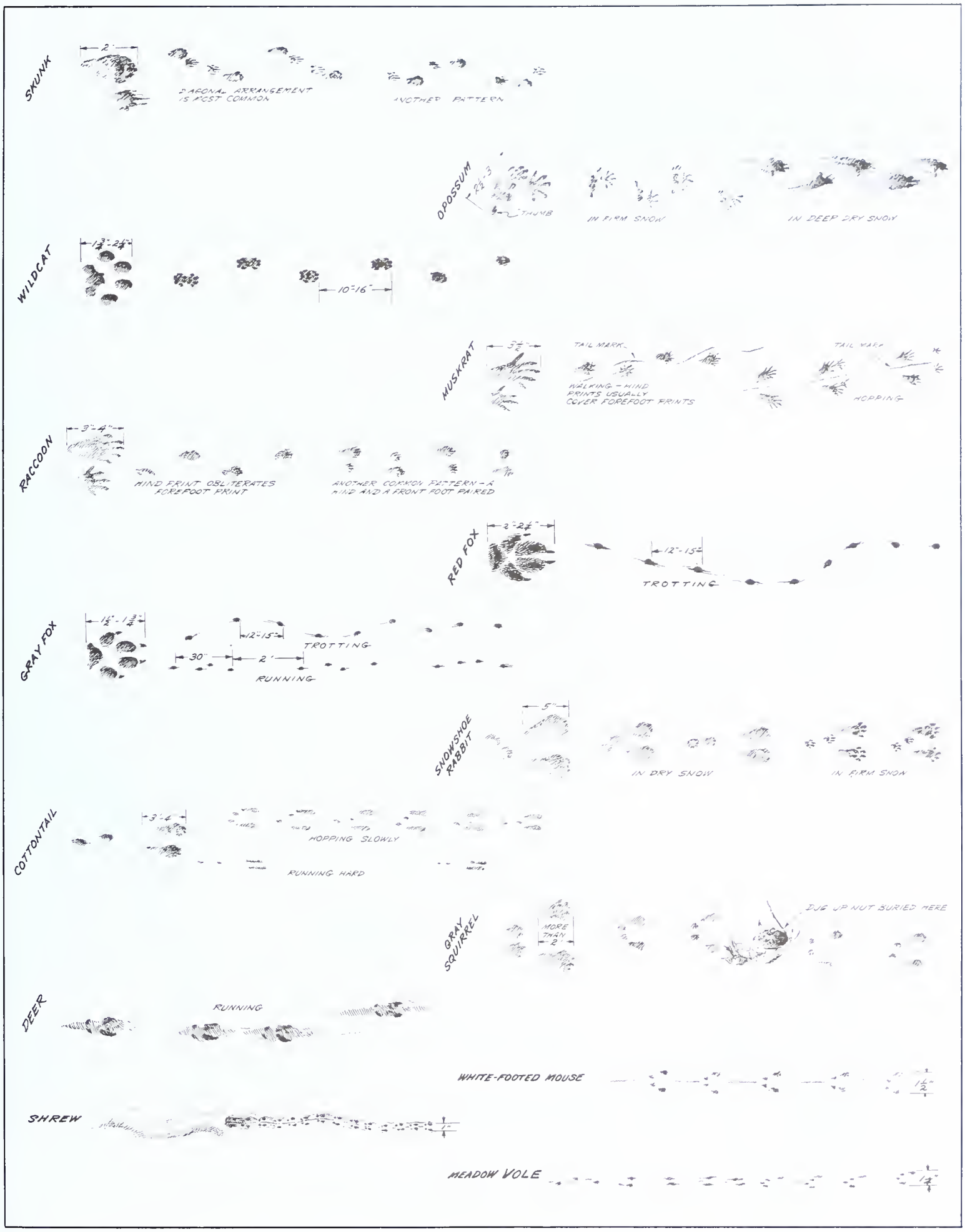
Place 10 bird boxes (more or less) along the edge of your woodland and another 10 in the forest. If you have one or more fencerows dividing fields on your property, place a third set of 10 boxes on fenceposts. The section in this book titled "Songbirds" includes information on boxes which are attractive to a variety of cavity-nesting birds. If building bird houses is a winter project for you, try to have them placed before the end of March. Inspect these houses for use from the beginning of May through mid-June. A few Sunday strolls should do nicely for inspections. Comparing year to year use of these houses and the kinds of birds using each set of houses will make interesting entries in your log. Make a habit of repairing and emptying bird boxes in early March. How many were used by deer mice or flying squirrels for winter quarters? How many were packed full of twigs by a wren in the previous year? More entries for your diary, all interesting and flavored with the unexpected.

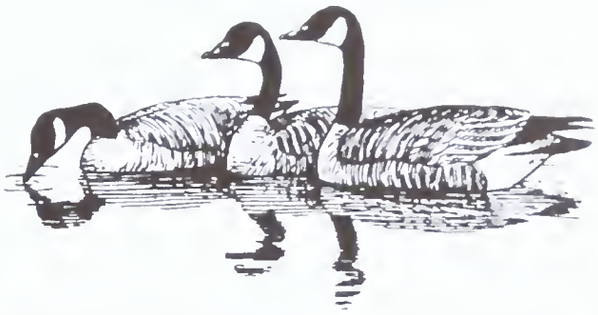
Pick the first good snowfall in December or January, wait a few days, and then hit the trail. Travel along the edge of your woodlot, by the pines, up a stream bottom, or on an old logging road. Record every animal track that crosses your trail. Sketch those you can't immediately identify. By walking the same snow-covered trail under similar weather conditions year after year, recorded tracks can serve as an index of abundance. If, for example, you see progressively fewer grouse tracks over a period of years, this could be interpreted, other things being equal, as fewer grouse.

Track counts or bird box surveys can be combined with a search for other animal signs. Tree holes, squirrel leaf nests, bird nests when no longer hidden by leaves, stray feathers, scats, owl pellets, gnawed bark, twig ends nipped off, mud slides, holes or diggings in the ground, seed caches, sapsucker drilling, and countless other signs indicate use of your woodland by different species of wildlife.

A diary can be educational as it will force you to observe and record. Ultimately a diary is a method of recall where forgotten trails are once again relived, and the pleasures of recollection stimulate anticipation of more days afield.

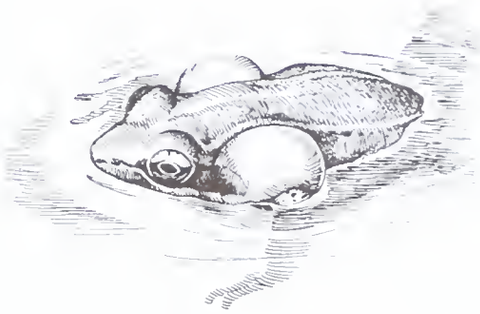



SKUNK
2"
DIAGONAL ARRANGEMENT IS MOST COMMON
ANOTHER PATTERN
OPOSSUM
2½"-3"
THUMB
IN FIRM SNOW
IN DEEP DRY SNOW
WILDCAT
1¾"-2¼"
10"-16"
MUSKRAT
5½"
TAIL MARK
WALKING - HIND PRINTS USUALLY COVER FOREFOOT PRINTS
TAIL MARK
HOPPING
RACCOON
3"-4"
HIND PRINT OBLITERATES FOREFOOT PRINT
ANOTHER COMMON PATTERN - A HIND AND A FRONT FOOT PAIRED
RED FOX
2"-2¼"
12"-15"
TROTTING
GRAY FOX
1½"-1¾"
12"-15"
TROTTING
30"
2'
RUNNING
SNOWSHOE RABBIT
5"
IN DRY SNOW
IN FIRM SNOW
COTTONTAIL
3"-4"
HOPPING SLOWLY
RUNNING HARD
GRAY SQUIRREL
MORE THAN 2"
DUG UP NUT BURIED HERE
DEER
RUNNING
WHITE-FOOTED MOUSE
1½"
SHREW
1"
MEADOW VOLE
1¼"



Managing Major Forest Habitats

There is a popular and romantic image of the forest as a timeless and unchanging place, a stately expanse of mirror-image trees. In reality, the forest is everchanging and diverse where forest meadows revert to brush and brush to trees and back again. Perhaps you can more clearly understand the changing character of the forest by examining the process of succession, that is, the progressive replacement of one plant and animal community by another.



Let's begin with a bare field and follow the progress of natural succession. After several years we typically find a heavy sod of forbs (broad-leaved weeds) and grasses growing in the field. This thick ground cover may inhibit the establishment of tree seedlings; however, after several years certain shrubs may appear. Blackberries that grow along the edge may begin encroaching into the field. Seed-eating birds that nest in the field may deposit seeds of trees and other shrubs with their droppings. Once a single plant is established, it can give rise to others through seeds or underground branches called stolons. Intolerant trees (trees that need full sunlight to survive such as aspen, fire cherry, and black locust) may invade the field along with various shrubs. These trees and shrubs will eventually shade out some of the grasses and forbs and thus pave the way for shade tolerant tree seedlings. Intolerant tree seedlings cannot grow in the shade of the parent trees, but tolerant tree seedlings such as sugar maple and beech can. Thus, as the tolerant trees grow, they will eventually shade out the shrubs, outlive the intolerant trees, and dominate the site.

In an undisturbed environment, these trees will grow old, die, and fall over, creating small new openings. Wind, fire, disease, and insect outbreaks create even larger openings which revert to the earlier grass or brush stage, and the successional cycle continues. Various forms of wildlife are adapted to the different types of habitat provided by different stages of succession. Some may require food and cover found in several successional stages. We are thus faced with a dilemma. We protect our forest as much as possible from the destructive effects of fire, insects, and disease, but these are the very forces that historically provided the habitat diversity vital to so many wildlife species.

Fortunately, the problem is not as bleak as it first appears. Forest landowners can produce the diversity that is lacking by a variety of

acceptable methods. Cutting most of the trees from a particular site has an effect similar to that of natural processes which set back succession. Harvesting a tract of timber sets a site back to the brush stage. Through thoughtful planning you can use these and other techniques to create a diverse forest that is attractive to a variety of wildlife. You can reserve certain sections or selected trees from cutting to provide dens for squirrels and woodpeckers. Strategically located evergreen cover can provide valuable winter cover for the pheasants in your field, cottontails in your brush, and songbirds from both areas.

Distinct habitat types must be provided on or adjacent to your property to simultaneously have the pileated woodpeckers and squirrels of the mature forest, the rufus-sided towhees of the brush, the nesting ovenbirds of grassy woodland openings, and the conifer-loving chickadees. Choosing to preserve your woodlot allows your timber resources to deteriorate, eliminates the many valuable shrubs and intolerant trees from the forest, and favors only those forms of wildlife that are suited to life in the mature forest. Vegetative diversity is the key to variety and abundance of wildlife on your property.

Herbaceous Openings

Herbaceous openings in continuous and extensive woodland can provide the diversity to sustain a greater variety of wildlife. Herbaceous plants are those that do not develop a woody stem. Herbaceous openings are areas where the ground is covered with a mixture of grasses and other herbaceous plants, and where there are few, if any, trees.

Grasshoppers and other insects that thrive in these grasses and herbs provide food for growing grouse chicks and turkey poults as well as a variety of songbirds. The plants themselves supply food for animals such as deer, bears, and older grouse and turkeys. And the ground cover provides highly desirable nesting areas for a variety of birdlife. Where might a grouse chick dry out better after a cool spring rain than in a sunny opening?

Would an herbaceous opening improve your woodlot? This depends on your interest and objectives. In general, between 1 and 3 acres of herbaceous openings in about 50 wooded acres will make your forest more attractive to a greater variety of birds and mammals. Perhaps you already have several herbaceous areas. Abandoned fields with scattered shrubs such as greenbriar and hawthorn are attractive areas, while heavily grazed pastures offer little for wildlife. Cutting small openings of at least ¼ acre or widening existing openings along access roads or trails provides an abundance of herbs and grasses that are not found under the dense forest canopy. These weeds and grasses can also be provided along the edge of woodlands if you neither pasture cattle there nor plow right up to the trees.

Herbaceous cover can be established either by seeding or by allowing native plants to invade a site. Several factors must be weighed in deciding which procedure to use. Where soil erosion may occur, the establishment of quick cover by seeding is important to protect the soil. Seeding also is recommended where there may be competition from certain prolifically sprouting woody plants such as locust or sweet fern. In such a case the

objective of seeding is to hold back the process of succession by establishing a thick, grassy sod that will inhibit the establishment of woody plants in the opening as long as possible. Seeding, however, involves costs for seeding, liming, and fertilizing. Where seeding is preferred, you may wish to request professional assistance.

The first step in creating an opening is to remove the trees. You will also want to remove most of the woody, understory vegetation. But retain a few large shrubs such as dogwood or hawthorn, and maybe a clump or two of gray dogwood, greenbriar, or viburnum along the edge. These will provide some cover in the opening as well as some additional food. Trees should be cut as low as possible or removed by bulldozing to minimize subsequent stump problems in site preparation. Stumps may be treated with herbicides to prevent sprouting. Root suckers of black locust, sassafrass, and sumac can be controlled with herbicides. Use herbicides according to label directions.

Site preparation for seeding is as follows: (1) disking, (2) liming, (3) fertilizing, (4) disking again, and (5) seeding. Have your soil tested for lime and fertilizer requirements. Make sure legume seed is inoculated. A less expensive alternative is to broadcast the seed by hand during early spring, preferably while frost heaving is occurring. County Extension offices can advise on seed and planting procedures.

	Seeding rate lb/acre	pH range	Soil condition
Birdsfoot Trefoil Orchard Grass	8 5	5.5-7.5	Well to moderately well drained
Birdsfoot Trefoil Timothy	8 4	4.5-7.5	Well to moderately well drained
Birdsfoot Trefoil Meadow Foxtail	8 6	5.5-7.5	Somewhat poorly to poorly drained

The eventual invasion by native grasses and forbs will not detract from the value of an opening for wildlife; however, these plants can be discouraged by mowing every 2 or 3 years. Check lime requirements every 5 years; it is unnecessary to lime more frequently. Where grasses predominate, you can fertilize by broadcasting 100 lb 10-10-10/acre every 2 years or as necessary to maintain the desired cover. Fertilize during August or early September. Where legumes predominate, broadcast 300 lb 0-20-20/acre every 3 to 5 years or as needed to maintain the desired cover.

Encouraging invasion by native herbaceous plants (even crabgrass and chickweed) can be as beneficial as planting, is less expensive, and is generally suggested on sites without serious erosion or competition from prolifically sprouting woody plants. Disturbing the soil on the selected site by tilling or disking with notched disks will hasten the establishment of herbaceous plants. If the trees are felled by bulldozing, the soil likely will be sufficiently disturbed. Bare soil exposed by the tracks of the bulldozer or where trees were uprooted by the bulldozer will provide adequate sites for establishing herbaceous vegetation.

Management of the opening depends on the kinds of birds and mammals you want to attract. They will determine the kind of plants that you want to encourage. Herbaceous plants can be divided into two major categories: perennials and annuals. The stems of perennial herbs die back in winter, but the underground parts survive and renew growth in the following season. In contrast, annuals depend entirely on large crops of seeds to sustain themselves from one year to the next. Consequently, these transient plants are more valuable to seed-eating wildlife than are perennials. Annual plants are the first to invade recently disturbed soil. Perennial species usually crowd out the annuals within 2 or 3 years unless plowing or other soil disturbances are continued. Therefore, where providing food for upland game birds and seed-eating songbirds is most important, openings should be tilled or disked every 2 or 3 years. These disturbances will favor seed-producing annual plants.

Some valuable seed-producing wild plants.
Dropseedgrass
Crabgrass
Panicgrass
Foxtail
Sedge
Sheepsorrel
Curly dock
Knotweeds and smartweeds
Lambsquarters
Pigweed
Chickweed
Clover
Ragweed
Dandelion

Some valuable wild-forage plants for wildlife.
Crabgrass
Panicgrass
Sheepsorrel
Pokeweed
Chickweed
Cinquefoil
Clover
Nightshade
Plantain
Dandelion

If providing forage for deer is an objective, mowing old fields improves the forage value of these sites by promoting the growth of succulent green grasses and forbes.

Establishing annual grains in food plots is an expensive operation. However, grains can be valuable in attracting wildlife to your nature trail, cabin site, or home. Food plots should be established on moderate to

well-drained, fertile sites that are open or have almost no shading. The following annual seed mixtures will attract a variety of wildlife:

	Seeding rate		
	lb/acre	lb/⅛ acre 100′ x 50′ plot	pH range
1. Buckwheat	3	1	
Foxtail millet	3	1	
Sudangrass	3	1	6-6.5
Soybeans	5	2	
2. Foxtail millet	3.5	1	
Grain sorghum (dwarf varieties)	0.5	0.2	6-6.5
Sunflower	1.5	0.5	

Lime and fertilize according to soil test. Seed annually from May 15 to July 1.

Brush

Is brushy cover in short supply in your neighborhood? Maybe your woodlot has thick brush near the edge where it is exposed to sunlight, but is there any brush farther back under the trees? Brushy woodland borders and fencerows along your fields provide travel and escape cover for cottontails and pheasants while patches of brushy cover scattered through woodlands provide feeding and loafing cover for grouse and woodcock. If about 10 percent of your forest land is covered with brush, you will enjoy the company of many birds and mammals that otherwise might shun your property.

There are two basic types of brushy cover: (1) young trees of the brush-stage forest, and (2) shrubs and vines. Creation of a young, brush-stage forest is accomplished most often and most economically by harvesting trees for wood products. Revenues from the sale of some of your trees can help finance wildlife habitat improvement, and the resulting growth of the young forest will provide brushy cover for 5 to 10 years. Removing part or all of the overstory allows more sunlight to reach the forest floor and encourages the growth of sprouts, shrubs, and tree seedlings.

The techniques of harvesting timber to create brushy cover can be applied in a variety of ways, depending upon the condition of your woodland, the size of your property, the location of other habitat types, and your personal objectives. Timber may be either clearcut (all the trees in a selected area are removed) or selectively cut (only some of the trees are removed). Proper selective cutting establishes scattered patches of brush in the understory. However, the amount of brush is dependent on the proportion of trees cut. The greater the harvest of trees, the greater will be the amount of sunlight striking the forest floor and the greater will be the resulting growth of brush.

Brush produced by selective cutting persists until the crowns of the trees in the canopy grow together and again shade the forest floor. On the

other hand, clearcutting is the best method of reproducing certain tree species such as black cherry, oak, and aspen. Perhaps a combination of the two techniques will best suit your needs. Contact a forester for professional assistance with timber harvesting.

Perhaps you do not have enough timber to sell, or your trees are not yet ready to sell. If this is the situation, you may establish brush by cutting several ½- to 2-acre openings or a 30-foot-wide border along the edge of your field. Select, if you can, areas where trees are poorly stocked or of poor quality. Cut the trees as low as possible to minimize subsequent problems with brush cutting operations. Cutting small areas should not be attempted where browsing by deer is likely to be heavy.

Remember that the forest is a dynamic system, and brush will normally last for about 10 years before it begins to grow into sapling-size and then pole-stage timber, at which time it no longer provides ground cover for the grouse or yellowthroat, nor browse within reach of the deer. Unless additional timber harvesting is planned, these small openings should be recut with a brush-hog every 5 or 6 years, or as often as necessary to maintain them in brush. New growth is most successful when cutting is conducted during October through February. Avoid disturbances during the peak nesting months of May, June, and July.

An alternative method of creating brushy cover is to increase the growth and distribution of shrubs and vines. Native shrubs such as gray dogwood, elder, greenbriar, hawthorn, witch hazel, scrub oak, and viburnum can be quite valuable for wildlife. However, full sunlight is important for many species. When shrubs such as blackberry, hawthorn, and witch hazel are shaded by a dense canopy, their vigor wanes and fruiting declines. Brushy cover can be created where these shrubs exist by removing part or all of the overstory. The additional sunlight that results will encourage growth and fruiting of the shrubs.

Shrubs can be particularly valuable when establishing small areas of brushy cover since they are easier to maintain than the brush-stage forest. Maintenance of shrubby areas may be limited to felling or girdling trees that threaten to overshadow the stand. There are, however, certain shrubs that benefit from additional attention. Alder becomes decadent with age and should be cut periodically to regenerate a healthy stand. Alder should be cut around age 20 to 25. Cutting one-fourth of an alder stand every 5 years will result in a desirable mixture of different-aged alder. Blackberry and raspberry can be mowed to stimulate sprouting and to eliminate competing vegetation.

Native shrubs are particularly valuable for wildlife and should be encouraged where possible. The era of native shrubs and vines in Pennsylvania reached its peak between 1900 and 1920. At that time vast acreages were reverting from farm and pastureland while lumbering operations had converted extensive acreages to brushland. Conditions of rural living — including small fields, and extensive acres of pastureland and fencerows — in combination with early lumbering operations enabled native shrubs to flourish and increase in abundance. Now, however, intensive farming, use of herbicides, and conversion of abandoned farms to closed canopy forests have caused native shrubs to decline on sites where they formerly were abundant.

Shrub planting generally is not recommended in woodland

management. However, there are several situations where planting can be beneficial. First, it is often desirable to establish brush in a field in which there is little or no woody growth. Remember that establishing a successful planting may be difficult where palatable species are subject to immediate and heavy browsing by deer. You may also have to protect the seedlings from gnawing rodents, particularly in grassy areas. Second, where small plots are to be managed for permanent stands of brush, planting may be a valuable technique. Shrubs are more desirable than young trees in such areas since they require less maintenance once established. Where there are no native shrubs that can be encouraged to invade a site, planting is appropriate. Planting shrubs can be beneficial for songbirds in special areas such as around cabin and home sites or near small ponds.

Sapling and Poletimber Stands

After about age 10, trees grow out of the brush stage and into the sapling-stage forest. Trees from 4 to 12 inches in diameter are referred to as poles. At this stage the overstory foliage is too high to be of any value to browsing animals, and so dense that, by shading, it supresses production of understory food and cover. Pole-size trees, by virtue of their age, small diameter, and crowded crowns do not make desirable den or nesting trees. More importantly, they do not produce many nuts or seeds. The typical pole-stage forest is poor wildlife habitat.

The management of poletimber stands for wildlife should be aimed at increasing the growth of selected trees and creating greater habitat diversity. If you have a pole-stage forest, you may wish to conduct timber stand improvement. Timber stand improvement is a technique of removing some trees to obtain better growth on the remaining uncut trees. Also it will result in earlier and more prolific fruit production in the residual trees. Removal of some trees allows sunlight to reach the forest floor and results in a temporary increase in ground cover. The ground cover will persist for 3 to 5 years until the crowns of the remaining trees grow together and once again shade the forest floor. Poletimber stands ideally should be thinned every 10 to 15 years. Place emphasis on retaining valuable shrubs and maintaining the existing diversity of tree species. Thinning during winter provides browse from the felled tree tops at a critical time for deer.

Since the ground cover created by timber stand improvement is only temporary, you may wish to break up a large pole stand with several small clearings. For example, creating several 1-acre herbaceous openings totaling 2 to 5 acres in a 100-acre stand and several brush patches totaling about 5 to 10 acres in the same stand will markedly improve habitat conditions.

Pole-size trees typically are not large enough to provide holes for cavity-nesting birds and mammals. The absence of dens in pole stands can be partially offset by providing wooden nest boxes. These boxes can provide surprising results with a variety of cavity-nesting wildlife such as squirrels, woodpeckers, and screech owls. Hang the boxes between 10 and 30 feet high. Do not use nails in trees that may eventually be cut for timber

as this will reduce lumber value. You will achieve best results if you construct the box so you can remove the old nesting material annually.

The undesirable characteristics of pole-sized stands of trees decrease when the trees are around 35 years old. Eventually seed production increases and the trees become a rich source of food. This food source is augmented by a gradual increase in understory vegetation, which is characteristic of old stands.

Mature Woodlands

Mature woodland provides cover for canopy-nesting birds; acorns, or other tree fruits and nuts (called mast), which are consumed by many different animals; and tree holes for squirrels, raccoons, woodpeckers, opossums, and a variety of songbirds. In addition, insects that live in dead or dying old trees provide food for woodpeckers and other bark-probing insectivorous birds.

Quality of mature woodland for wildlife depends on several factors, the most basic being forest type. The two forest types that are more common in Pennsylvania are mixed oak, which occurs in the southern two-thirds of the state, and northern hardwoods or beech-birch-maple, common in the northern third of the state.

One important difference between the two forest types is food production. In the oak type, all the oaks as well as hickories and an occasional beech or walnut, may produce mast. In northern hardwoods, mast is produced by cherry, beech, and an occasional oak or hickory; however, beech produces a good nut crop only occasionally. The management of a woodland should be designed to insure a continuing supply of vigorous 40- to 80-year-old mast-producing trees of several different species. A stand composed of different species usually will not result in a total mast failure for the year.

For example, suppose weather for acorn development is good one spring but bad the following spring. There will be no white oak acorns the year of adverse weather since white oak acorns develop in one year, but you will have a good crop of red and black oak acorns from the previous year since these take two growing seasons to fully develop. With only white oaks in your woodland there would have been no mast production in the year of bad weather. If your woodland contained only red or black oaks, there would be no acorns the second year following the adverse weather.

Insects or diseases frequently attack only a certain species of tree. Consequently, a mixture of mast-producing trees tends to be more reliable as a source of food for wildlife.

Consider these steps if there are few or no trees of mast-producing age. Reserve all mature seed-producing trees and conduct timber stand improvement in younger stands of trees. Timber stand improvement is basically a process of removing poor quality trees to obtain better growth on trees remaining in the stand. This will result in earlier and more prolific fruiting of the remaining trees. Favor improvement in stands that are relatively free of disturbance rather than those adjacent to a highway. Use timber harvesting techniques that assure the reproduction of a variety of tree species. Finally, when harvesting timber, leave a few den trees. These should include, but not be limited to, some dead trees. It'll

take 40 to 60 years for new den trees to develop. Professional foresters can advise you regarding timber stand improvement.

Evergreen Cover

Evergreens may seem both abundant and scarce in Pennsylvania, depending on the locale. Hemlock and rhododendron shade many stream bottoms in the mountainous areas of the state while mountain laurel adds a touch of green to snow-covered ridges. White pines dot the forest in some sections, and in a few areas spruces mark wet boggy soils. Yet in many areas of the state, the only existing evergreens are those that were planted.

The most common use of evergreens by wildlife is as cover from cold winter winds. Several clumps of about six shade-tolerant evergreens, such as spruce, underplanted at a spacing of 6 by 6 feet in each acre of deciduous woodland, provide valuable winter cover for a variety of birdlife. A mixed stand of scattered conifers and deciduous trees will carry a greater diversity of forest-dwelling songbirds than a pure stand of either type alone. The seeds of various evergreens are a favorite winter food for red squirrels. Evergreens planted along a road act as a year-round screen that can reduce human disturbance and encourage greater wildlife use of adjacent areas.

Evergreens also provide more than winter cover for wildlife. Some birds, such as the mourning dove, nest primarily in evergreens. Songbirds may seek the shelter of evergreens to escape attacking hawks. Other evergreens may provide nesting sites for those same hawks and owls. Finally, evergreen leaves or needles can be an important deer food in winter when other vegetation is not available.

The value of evergreens for wildlife depends on the species, size, and age of the evergreen stand and its proximity to other cover types. The most effective evergreen cover is located near brushy areas or small herbaceous openings. Tall, mature conifers in one area and low-growing evergreens such as rhododendron, mountain laurel, or young conifers nearby will satisfy the needs of a variety of wildlife. Two to 5 acres of evergreens in each 100 acres of forest land should provide adequate cover.

You may wish to plant conifers if there is little evergreen cover in your area. A corner of an old field is a likely site for a conifer plantation. Establishing a C-, J-, or S-shaped plantation will provide more edge than a square or rectangular shaped one. Where a new plantation is to become part of an existing plantation, leave unplanted areas between the old and new plantings. In this way brushy or grassy areas next to the plantation not only benefit wildlife but they can provide fire breaks between new plantings and established trees.

Planting trees at a 10-by-10-foot spacing will benefit cottontails, showshoe hares, and grouse because the lower branches live for a longer time and the wide spacing allows herbaceous vegetation to grow between the trees. Once conifers reach a height of about 4 feet, cottontails will begin to frequent the area. At 6 feet, the lower limbs of the trees will begin to grow together and provide winter cover for cottontails. This condition will persist until the lower limbs become shaded and die.

Planting the outside row of a pine plantation with spruce, which is a slow-growing shade-tolerant species, will improve the cover value of the plantation. The lower limbs of spruce are retained longer than pine. After the lower limbs of the pine become shaded and die, spruce trees continue to provide an edge that will reduce the flow of wind in the interior of the plantation and act as a visual barrier.

When a pine plantation reaches a height of 10 to 15 feet, about 10 years after planting, the area is comparable to a thickly overgrown field but with considerably more effective cover. Crowns usually have not grown so close together that they eliminate all herbaceous ground cover, and the lower branches still remain. At 20 to 25 feet the crowns form a solid canopy and the lower limbs become shaded, die, and fall off. This natural pruning of lower limbs reduces the cover value of plantations. Do not remove deciduous trees that invade the plantation. Deer seek cover in plantations and feed on deciduous browse. Establishing a source of winter deer food near plantations may make them more attractive to deer. Hawks and owls nest in tall conifers.

Planting conifers requires discretion. Creating new evergreen cover does not increase the diversity of a woodlot if it eliminates another cover type. Planting an entire field to conifers, in an area where there are few herbaceous openings, ultimately replaces an existing herbaceous opening with conifers. In that case, it would be better to plant only part of the field or to plant a few clumps of conifers if the field is small.

Caution should be exercised when establishing conifer plantations since too few evergreens may favor predators. If there are few evergreen stands in an area, many birds and mammals may seek winter cover in a limited number of places. Under such conditions, predators may find it much easier and more efficient to concentrate hunting efforts in the evergreens.

Wetlands

Wet areas are valuable to all wild birds and mammals and are essential to existence of certain species. One investigation of areas around mountain impoundments in north-central Pennsylvania identified 21 mammal species, 101 bird species, and 2 species of reptiles. Another study found that although blueberry and rhododendron swamps comprised about 8 to 10 percent of the cover type in northeastern Pennsylvania, such swamps accounted for 70 to 80 percent of the bear observations in the region. A list of animals found in or near wet areas includes: mallards, wood ducks, black ducks, greenwing teal, pied-billed grebes, green herons, woodcock, cedar waxwings, northern and Louisiana waterthrushes, alder flycatchers, belted kingfishes, prothonotary warblers, water shrews, bats, mink, raccoons, and muskrats.

Wetlands have other values which include providing special outdoor classrooms; storing and slowly releasing ground water; creating firebreaks; and producing blueberries, cranberries, peat moss, sport fish, and other valuable natural resources.

Due to plant succession many wet areas now lack open water. In effect yesterday's pond or marsh is today's sedge meadow, tomorrow's alder thicket, and someday a forest. Uninterrupted, this parade of plants will bring deer trails where wood ducks once swam. Techniques to arrest or

reverse succession will be discussed later.

Diverse types of vegetation around puddles and channels of open water are desirable for waterfowl. Such a diversity is provided by a patchy network of open water, marsh grass, brush, and large trees. An ideal wetland for waterfowl consists of about one-third open water and two-thirds marsh.

There are several methods of improving wetlands for wildlife such as impounding or exposing water, and cutting or planting vegetation. Advice from a wildlife biologist or forester will be valuable.

Swamps and wet meadows may drain through restricted openings, as small as a few feet across. If such a restriction can be found, it is a good place to locate a small water-control structure. A small dam of logs, rocks, or thick planks may be all that is needed to impound an acre of water. The best structure allows regulation of the water level which can be useful in managing food and cover within and around the pond. Rarely should a shallow marsh be over 2 feet deep.

Once a small dam is constructed, it must be maintained. Reconstructing and strengthening old beaver dams may be productive. Areas of open water may fill with muck or choke with vegetation. Hidden water can be exposed by bulldozing, using a dragline, or blasting. Material removed from ditches and potholes should be mounded nearby. This high land can be valuable, especially when planted to good seed-producing plants.

Large dams are not suggested. Except for fish, deep water is not as valuable for wildlife as shallow water. A single, deep (more than 12 inches deep), small (less than 2 acres) pond is not as widely used by different kinds of birds and mammals as a series of smaller, shallow ponds, potholes, and channels.

Vegetation management may be the most practical method to improve wet acreage. Clearcutting or girdling large trees in patches of one to two acres in size can increase standing surface water in spring and summer. Small patch cuts and the establishment of one or two permanent herbaceous openings around wetlands will make the entire area more attractive to wildlife.

Den trees should not be cut. The absence of den trees may indicate the need to build a few wood duck nest boxes. Erecting bluebird houses along wetland meadows may yield rewarding results.

Cattail marshes sometimes can be improved by thinning the vegetation. Small areas of open water scattered within the cattails make these areas much more attractive to songbirds. Where there is little or no open water in cattail marshes, prudent grazing may be employed as one means of improving the area.

This short discussion of wetlands introduces a few ideas. Each small area is unique. Millions of acres of swamps and marshes have been lost because of draining, filling, and impounding water. Wetlands have been called our most endangered habitat. Anything that landowners can do to preserve and improve wetlands will yield benefits far beyond their boundaries.

Forest Wildlife

The forest wildlife community includes those animals that spend most of their time within wooded habitat. These species use nonforested areas such as fields and open lands but depend heavily on the forest for food, cover, nesting, and loafing areas.

Some species may be permanent residents, others may be occasional visitors, and still others may visit your property only during migration. Consider the total area you have to manage. For instance, wild turkeys cover a considerable range (2,000 acres) and you should not expect to hold them within a small tract of land. Squirrels, on the other hand, will reside in a small woodlot (1 to 3 acres). Regardless, any habitat improvement will likely yield additional wildlife viewing pleasure.

Let's now consider specific animals and the things you can do to attract them to your woodlot. Recall that changes in both vegetation and wildlife useage patterns require time (1, 5, 10 years) and patience is the rule. Also, since you cannot observe your property at all times, you may initially be unaware of the good you are accomplishing. Brushing up on reading animal signs will enable you to confirm unnoticed nocturnal and secretive visitors. Deer runs, turkey scratchings, owl pellets, woodpecker drillings, and a host of other telltale reminders are indications of the effectiveness of your efforts and may be useful in compiling your nature journal.

Consider as many of the following suggestions as you can, but be aware that all species cannot be accommodated by even the most comprehensive management plan. We have included some natural history information so you can better understand land management suggestions. Also study the recommended readings to better understand the range of possibilities and grasp the limitations of your woodlot.

White-tailed Deer

It's not surprising that the white-tailed deer is Pennsylvania's official state animal, since it is one of the most popular and most commonly seen mammals of our state. The white-tail, an extremely adaptable creature, is found from the extensive forests of the northern tier to the small woodlots of the farm country and even the suburbs of our largest cities.

Life for the white-tail begins in late May or early June when a doe gives

birth to one or two spotted fawns. These young deer spend the first few days of their lives moving little and taking advantage of their spotted camouflage to escape notice. At this time the dense thickets on your property such as laurel, gray dogwood, or honeysuckle will provide refuge for them. The fawns become quite agile after two or three weeks, and their spotted coat disappears after three or four months.

In April antler growth begins in the adult males. The size of the antlers is governed by the age, nutritional health, and genetic potential of the animal. The antlers grow rapidly until August; then they harden and the velvet (a fuzzy coating of blood-filled living tissue) is sloughed off. The bucks try out their antlers first by rubbing them against small saplings, a prelude to the vigorous treatment they will soon receive. Rubbing the antlers in this manner strips bark from the trees and produces what are known as "buck rubs." As the mating season or "rut" approaches, the bucks become more and more aggressive and joust vigorously with trees and bushes as if they were challenging males. The breeding season reaches its height in November, although some breeding occurs in early October and as late as January.

Winter is the critical season for white-tails, particularly in some of the heavily-forested sections of the state where food is scarce. Malnutrition occurs when the deer population exceeds the carrying capacity of the range. Fawns fall victim first since the limited food is quickly consumed by the larger, more aggressive deer. Only the fittest survive until the lush green grasses and forbs of springtime end winter's austerity. Supplemental feeding by landowners may help small groups of deer, but artificial feeding is not practical on a large scale. The white-tail's lifelong residence covers about a square mile. For this reason you cannot expect deer to be permanent residents of your small woodland. Your management will determine how frequently they visit.

Although deer are adaptable, they spend most of their time in the brush. Twigs, buds, and leaves from trees and shrubs make up a major portion of their diet. Thick brush provides excellent cover.

Creating brush is the most commonly used technique for improving white-tailed deer habitat. This subject is discussed in greater detail in the section on brush; however, several points are important enough to repeat.

Two types of brushy cover are: (1) young trees of the brush-stage forest, and (2) shrubs and vines. One of the best sources of food and cover for deer is the brush-stage forest. The most common and most economical method of creating this habitat type is through timber harvesting. Timber harvest removes the leafy canopy so more sunlight reaches the ground. A new growth of young trees provides food and cover for deer for about 10 years. After that time the twigs have outgrown the reach of browsing deer.

When timber is harvested in an area with a high deer population, it is important that the total area cut is large enough to provide more food than the deer can eat. If only a small area (1 to 5 acres) is cut, the deer will eat all the young tree sprouts. Unpalatable grasses, ferns, and low-growing shrubby vegetation will prosper and eventually eliminate desirable regeneration. Professional foresters can suggest the proper site, size, and time for a timber harvest on your property.

Shrubs and vines comprise the second type of brushy cover. Shrubs can be encouraged to grow by removing some of the larger trees, which allows more sunlight to reach the understory. Some food producing shrubs which commonly occur in the understory are: blueberry, flowering dogwood, witch-hazel, serviceberry, and viburnum. Desirable wildlife shrubs and vines that need nearly full sunlight are: blackberry, crab apple, grape, raspberry, greenbriar, hazel, and hawthorn. Although these species may fare well at the forest's edge, they will not grow well in the understory without vigorous thinning of the overstory.

Planting shrubs as food for deer generally is not recommended. Shrubs are difficult to establish where they are subject to immediate heavy browsing by deer. Fencing small areas to prevent overbrowsing is usually too expensive for consideration.

Another method of improving deer habitat in extensive forest areas is to create openings, often called winter browse cuttings. A 2- to 5-acre opening is best, but an opening as small as ¼-acre will be used. These openings can be cleared and then seeded to Kentucky bluegrass, meadow foxtail, orchardgrass, or tall fescue, and a companion legume such as birdsfoot trefoil. An old field can be mowed early in spring to encourage grazing. Mowing will improve forage value by promoting the growth of succulent green grasses and forbs.

Evergreens also are important to deer. They provide valuable shelter and escape cover during winter. Conifer plantations of spruce and pine as small as 5 acres provide excellent shelter for deer once the trees are 10 to 15 feet high. Conifers continue to provide valuable cover until the lower, living branches are 15 to 20 feet off the ground and the understory is very open. Older plantations provide good cover if the outside rows have been planted to spruce, which retains its lower limbs longer. Spruce provides an effective visual screen and protection from cold winds. Pruning the dead lower branches in conifer plantations should be limited to only the most valuable timber trees since extensive pruning reduces the cover value of the plantation.

Perhaps the easiest technique for attracting white-tails is to properly care for old fruit trees on your property. Deer are fond of apples, and

there are many neglected apple trees scattered throughout the state. Apple trees can be encouraged to fruit by: felling or girdling other trees shading the apple tree; removing vines from the apple tree; pruning dead branches from the apple tree; and moderately thinning the remaining branches.

You don't have apple trees? Then consider planting some. Your planting stock should be 5 or 6 feet high to prevent deer from stripping the tree of its twigs and foliage. Apple trees should be protected from deer damage by encircling the trunk with a cylinder of wire mesh. A ¼-inch wire mesh will keep out gnawing rodents as well as deer. Bury the wire at least 6 inches deep.

Apple trees can be fertilized to improve production. Fertilize before the soil freezes in late fall or in early spring, using 1½ pounds of urea per tree. Make 10 to 15 small holes about 1 foot deep around the periphery of the tree. A digging bar or crowbar works nicely. Pour the fertilizer into these holes. Do not spread fertilizer on the ground surface since this will result in a lush growth of grass which will compete with the tree for water and nutrients.

Whatever you decide to do for deer, consider the land-use patterns of properties surrounding your land. If you are surrounded by mature forest with little brush, harvesting timber on your land is the best thing you can do to improve deer habitat. If your timber is not mature, consider an herbaceous opening. If you are surrounded by old fields, establishing a conifer plantation might be a good idea. Remember that deer are wide-ranging animals, and you may not be able to provide for all their needs. Your efforts will be best rewarded if you consider the surrounding area and establish whatever need is in the shortest supply.

Ruffed Grouse

The ruffed grouse is well known for its drumming in the spring and its explosive take-off when flushed. The grouse is a bird of the brush-stage forest. Populations vary from year to year as a result of weather, disease, and predation, but long-term changes in local populations usually are a result of changing habitat.

Nesting in Pennsylvania begins in mid-April. The hen typically nests at the base of a tree or stump near the edge of a clearing. The ruffed grouse lays 8 to 15 eggs and the chicks hatch in about 24 days. The average brood size by fall is about five or six birds. At this time immature birds may be distinguished from adults by pointed tips on their outer two wing feathers.

Good year-round ruffed grouse range should contain at least three habitat types: brushy and low growing ground cover for rearing broods and for supplying summer and fall foods; deciduous woodlands for nesting and for fall, winter, and spring foods; and low-growing evergreens such as spruce, hemlock, and laurel, or thick grape tangles for winter cover. All three habitat types should occur within an area of 40 acres.

The necessary elements of grouse habitat that are absent from your property can be established by a variety of practices. For example, brushy thickets could be established by clearcutting about 10 percent of your area

in one-half acre plots or in strips 80 feet wide along roads, firebreaks, and field edges. The sprouting that results will provide brush for about 10 years. Remember that brush may be difficult to establish in small plots where there is heavy browsing by deer. If browsing by deer is severe, fencing the area for 4 or 5 years will help establish the vegetation. This may be expensive, but in some localities it will be the only way to successfully establish brushy vegetation on small areas. Commercial harvesting of timber is a valuable alternative to these techniques. Selling timber will provide money, and properly planned timber harvests will successfully produce brush despite browsing by deer. Professional foresters can advise you concerning timber harvests.

You also can create brush by removing trees that shade shrubs such as hawthorn and gray dogwood. Most shrubs do not grow well in the shade but thrive in full sunlight.

Aspen is valuable to grouse. The large flower buds of mature male aspen are a favored grouse food, and the dense stands of young aspen provide excellent brushy cover. Manage aspen stands to produce both young and mature trees. This can be accomplished by cutting one-quarter of your aspen stand in the winter. The resulting sprout growth will give you a stand of young aspen. Cut an additional quarter of the stand every 10 years. After 40 years you will have four separate stands aged 10, 20, 30, and 40 years. By cutting the oldest section every 10 years you will have both young and mature aspen. If your stand is large enough you may be able to sell the aspen as pulpwood.

You don't want to wait that long? You may not have to. For example, if a portion of your aspen is about 35 years old and the remainder is 10 to 15 years old, you can establish three age classes immediately by cutting part of either stand. Age of aspen can be determined with an increment borer, which a forester will have, or simply by felling a representative tree and counting the rings.

Since aspen requires full sunlight to resprout, cutting a plot smaller than one acre will likely be unsuccessful. Cut part of the adjacent stand if necessary to make the clearing large enough to allow plenty of light to reach the forest floor. Aspen matures around 40 to 50 years of age after which it declines rapidly. Trees cut after this time may no longer sprout. Also, young aspen may be difficult to establish where subjected to heavy browsing by deer.

Escape cover should be provided along the edges of large open areas such as abandoned fields. The cover can be of any type of brushy vegetation as long as it affords protection for the birds. Try transplanting some native shrubs from an adjacent area. If none are available, ask your nursery for alder, hawthorn, gray dogwood, blackberry, raspberry, autumn olive, or any of the viburnums. Seedlings occasionally are difficult to establish in this situation and may need protection from gnawing rodents and browsing deer. Place a cylinder of ¼-inch wire mesh around the seedlings. Bury the end 6 inches underground to prevent rodents from burrowing underneath.

Winter cover can be created in deciduous woodland by underplanting with evergreens. Scatter five or six clumps of evergreens per acre. Use evergreens that thrive in the shade, such as spruce or laurel.

Grape thickets hold snow and form pockets where grouse may seek

shelter during winter. Also grouse may find some grapes that have persisted on the vine. Grape thickets should be maintained and encouraged to spread and fruit. Cutting trees adjacent to thickets will allow more sunlight on the vines. If your grape vine does not fruit, you may have a male plant. Remember that many small areas of winter cover are better than a few large ones.

Herbaceous areas provide good cover for grouse broods and should be included in your management plan. Weeds such as dandelions, wild grasses, and wild strawberries can be established by cutting small woodland openings and tilling or disking the soil. Ideally, there should be about 3 acres of scattered openings per 40 acres of woodland, each opening about ¼-acre in size. Herbaceous openings near brushy cover are most likely to be used by grouse. Additional information can be found in the section titled "Herbaceous Openings."

Seeding 5 to 8 pounds of white dutch clover per mile on roads or trails will attract grouse and provide a favorite food. However, this can be an expensive practice. These plantings should be maintained by monthly mowing and top dressing with fertilizer every 2 years during July and August or as necessary to maintain the clover. Check lime requirements every 5 years. This method of maintenance will provide a rather lush growth of clover.

A less expensive alternative is to conduct no maintenance at all and simply reestablish the clover after 3 to 5 years or when necessary. Although this method will not produce a lush growth, there will be enough clover for the grouse until it is nearly eliminated. Heavy browsing by deer also can hasten the elimination of your clover.

Wild Turkey

The eastern wild turkey is a fine example of a species that received a helping hand from wildlife managers. Only a few flocks remained in southcentral Pennsylvania at the turn of the century. Now the range of the wild turkey includes most of the northern mountainous part of the Commonwealth. The chance of turkeys visiting your woodlot is good.

As our largest game bird, adult male turkeys average around 18 pounds, but may weigh as much as 25 pounds. Adult females are about half that size. The beard is a characteristic feature of adult males although hens occasionally have beards. Beards do not indicate the age of the bird. Males can be distinguished from females more accurately by examining the breast feathers. The outer tips of the gobbler's breast feathers are smooth and black, while outer edges of the hen's feathers are brown with a fringed tip.

Young turkeys, called poults, usually are hatched in early June and spend the summer with the hen. Sometimes two or more family units of hens and poults may congregate to form a flock. These flocks may periodically separate with some individuals switching flocks or the combined family units may remain intact until fall. Their movements during this time are related to their search for food. Then during the winter, the young males, called toms, will leave the hens to form separate, sex-segregated flocks. Older gobblers also separate into groups of their own and do not mingle with the hens or poults.

In early spring gobblers stake out their strutting grounds and attract a harem of hens for the mating season by their loud gobbling. After mating, the hen will select a likely spot — usually under some brushy cover — where she will lay her clutch of about 12 eggs, thereby beginning another reproductive cycle.

Unless you have a large tract of land — more than 2,000 acres — it is unlikely turkeys will remain on your property year-round. Managing for this mobile species then is a matter of providing habitat that will encourage these birds to use your property periodically.

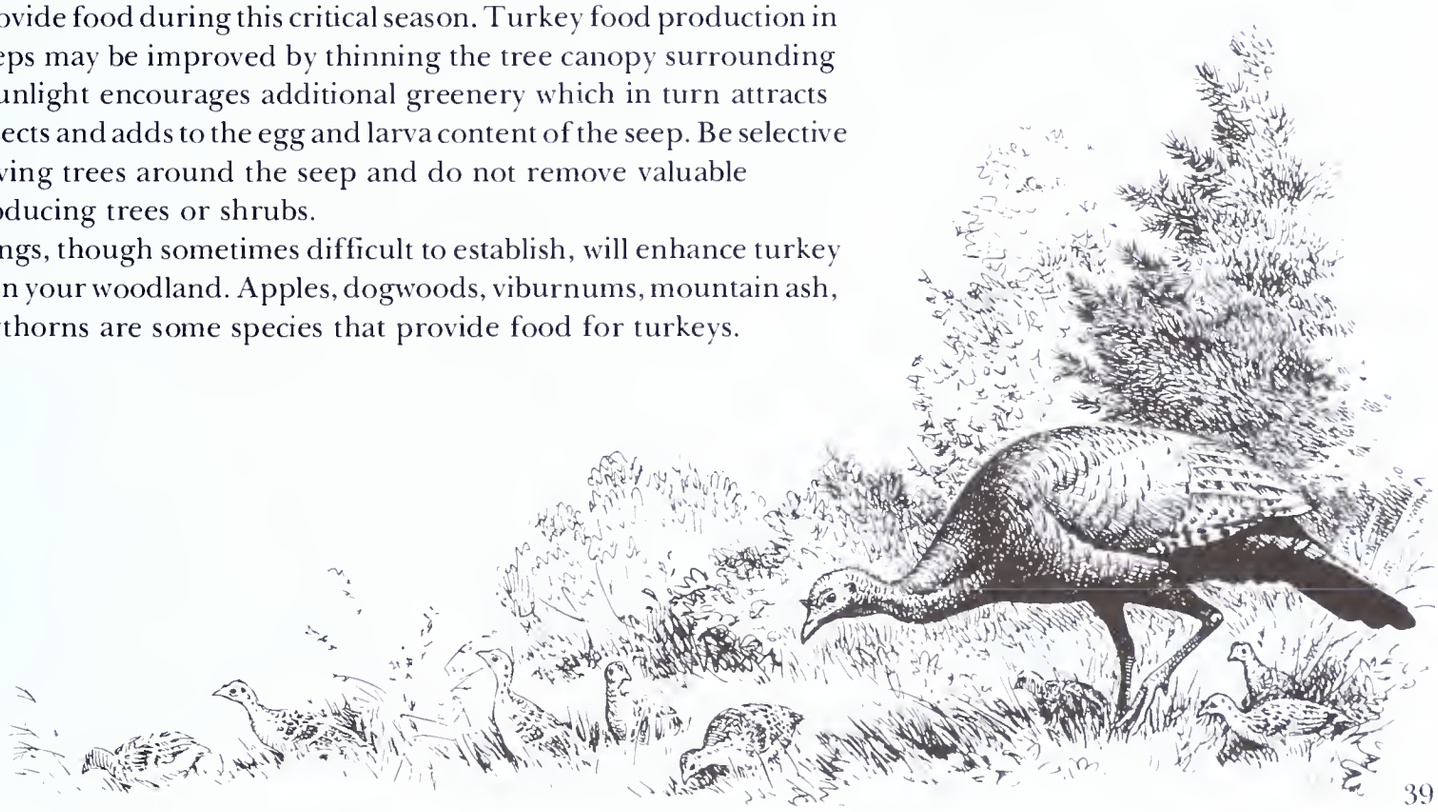
Forest management for turkeys should encourage a high proportion of older, food-producing trees such as oak, cherry, hickory, beech, and ash. Young stands of trees can be thinned to encourage growth of more productive seed trees. Consult a professional forester to see if thinning is appropriate for your woodlot.

Another management technique is woodland cutting to remove some of the overstory trees. Cuttings enhance the growth of grape, dogwood, viburnum, hawthorn, and other important shrubs of the understory. Such cuttings can be valuable for improving habitat.

Especially important to turkey poults are forest clearings of grassy and weedy areas containing scattered trees. In these spots, young turkeys depend on the security of weedy cover while capturing protein-rich insects important for their early growth. Removal of the canopy allows sunlight to reach the ground and encourages a lush growth of plants which abound with insects and other small invertebrates. Clearings as small as ¼-acre on your land can enhance the environment for turkeys and other wildlife as well.

Spring seeps — areas where ground water emerges to the surface along hillsides or other locations — are important to winter turkey populations. Since the temperature of the water is above freezing, the seeps remain open throughout the winter. The vegetation and insect larvae found there provide food during this critical season. Turkey food production in these seeps may be improved by thinning the tree canopy surrounding seeps. Sunlight encourages additional greenery which in turn attracts more insects and adds to the egg and larva content of the seep. Be selective in removing trees around the seep and do not remove valuable seed-producing trees or shrubs.

Plantings, though sometimes difficult to establish, will enhance turkey habitat on your woodland. Apples, dogwoods, viburnums, mountain ash, and hawthorns are some species that provide food for turkeys.



Squirrels

Squirrels probably are the most commonly seen mammals of the forest. Of the different kinds, gray squirrels are most abundant. They prefer extensive deciduous forests, but can adapt to suburban woodlands and city parks. Black squirrels, whose color varies from glossy- to brownish-black, are color phases of the gray squirrel. Fox squirrels, found mainly in western Pennsylvania, inhabit mature, open woodlots, fencerows with large trees, or scattered old oaks in open pastures. Red squirrels prefer conifers. Flying squirrels, active only at night, live in deciduous forests.

Gray, fox, and flying squirrels require mature deciduous forests with trees old enough to produce seeds for food and hollow cavities for dens. Red squirrels need mixed forests composed of both deciduous and coniferous trees. At about 25 years of age trees begin to produce food for squirrels. The best dens are found in trees over 40 years old.

Squirrels make their homes in two kinds of structures: tree cavities or dens, and tree nests built of twigs and leaves. Squirrel dens are formed by natural decay after openings are created at branch stubs or woodpecker holes. Split trunks, hollow butts, or broken tops of trees offer temporary shelter and escape cover, but they make poor quarters for raising young. Leaf nests serve mainly as summer living quarters and for escape.

Good squirrel woods consist of oaks and hickories mixed with other species such as maple, ash, black gum, tulip poplar, black cherry, beech, and birch. Since conifer seeds are a favorite food of red squirrels, they seldom are found far from white pine or hemlock stands or conifer plantations. All squirrels vary their diet with seasonal foods such as berries, buds, flowers, and fungi.

Squirrels thrive best where there are suitable dens in live trees and a consistent supply of nuts and other foods. You should maintain a mixture of food-producing trees and shrubs in your woodland to enhance conditions for squirrels. Your management program should encourage such stable food-producing species as oaks, hickories, beech, black walnut, butternut, black cherry, maples, and dogwoods. Save all active den trees having signs of gnawing and usage at the entrance. You should have at least two den trees for each acre. Most den trees will be more than 15 inches in diameter — a size for vigorous fruiting — and thus provide double value when you preserve them.

You should use uneven-age management to maintain or improve conditions for squirrels. In this method, you thin or harvest trees singly or in small groups. Whether you are thinning a young forest or harvesting mature forest, you should retain those species producing squirrel food. Stands with a mixture of oaks are most valuable to squirrels. Acorns of white and chestnut oaks are preferred by wildlife, while red, black, and scarlet oaks produce acorns more consistently. Red oaks provide more dens, too, as these species have less decay resistance than white oaks. Seed production varies among individual trees of the same species so methods of thinning and harvesting should retain trees which you know to be heavy seed producers.

Squirrel den boxes have merit when your forest lacks suitable dens. Construct them of rough sawn lumber and of a durable wood such as white oak. Natural squirrel cavities have minimum measurements of 6

inches in diameter, 12 inches deep, and a 3-inch entrance hole. Dimensions of den boxes are somewhat larger to provide space for protective nesting material. Screech owls, sparrow hawks, and other cavity-nesting birds may use boxes erected for squirrels; although to attract these birds the entrance hole should be cut in the front. Hang den boxes 10 or more feet above ground in trees that will not be cut for timber, since spikes or lag bolts used to attach the box will damage saws. You should clean nest boxes each year. The universal nest box plans, materials, and directions on page 50 apply to boxes for squirrels, wood ducks, screech owls, and sparrow hawks.

Woodcock

The woodcock is a rather peculiar looking brushland bird. Its short legs, plump body, and long bill suit the bird well for its environment. The woodcock is nocturnal with considerable activity at dawn and dusk. The birds probe the soil with their long bills or turn leaves to obtain earthworms and other soft-bodied organisms. Favored feeding areas are damp or wet sites where earthworms are likely to be found close to the surface.

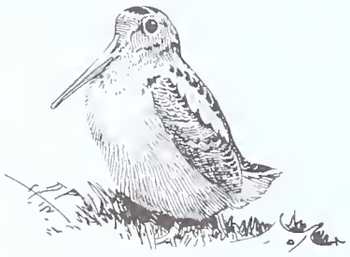
When cold weather limits the food supply, the birds migrate to warmer climates. Woodcock are among the earliest birds to return in the spring, arriving in central Pennsylvania in early March. Courtship and breeding begin immediately and extend until mid-May. The male woodcock performs an elaborate and spectacular courtship flight. During the flight he rises from a small herbaceous woodland clearing or a field near woodland, commonly referred to as a singing ground. Flying in ever tightening concentric circles, to a height of about 300 feet, he then drops down close to where he started. The first part of his descent is accompanied by a unique chirp-like song with musical qualities. This late evening display is worth a walk in the woods to see and hear. The female lays an average clutch of 4 eggs, which hatch in about 21 days. The average size of the brood is three chicks.

Woodcock require several habitat types. The most important of these is an area with a constant supply of earthworms. Woodlands having numerous moist, but not flooded, areas are good feeding sites for woodcock; so are shrub patches adjacent to streams, small watercourses, and springs. The best feeding areas are shrubby, with 25 percent of the ground covered by herbaceous vegetation. In addition to providing cover for the birds, shrubs shade the ground and prevent the growth of a thick sod of grasses and forbs which makes it difficult for the birds to probe.

Alder is a particularly valuable woodcock cover and should be managed where it exists. Alder should be regenerated periodically to prevent the stand from becoming decadent. Winter and spring cutting results in the most rapid sprout growth for alder. In 15- to 20-year-old stands you should plan to establish several age classes by cutting one-third of the stand as soon as possible and a second third after 5 years. If you then cut only the oldest third of the stand every 5 years, you will always have good cover. You can determine age of alder by simply cutting a representative shrub and counting the rings. Large trees that shade alder should be

felled or girdled since heavy shade will eventually eliminate the alder. Alder also has value in increasing soil fertility through nitrogen fixation.

Woodcock use brushy areas for resting cover during the day, and as nesting and brood cover. Aspen, hawthorn, and gray dogwood provide particularly good cover. Nesting sites are most frequently found at the edge of shrub thickets or sapling-seedling stands not far from the singing grounds. When brush is lacking, you can cut several scattered ¼-acre plots, with some plots near herbaceous areas. Establishing brush is discussed further in the section on Brush.



Courtship and mating take place in herbaceous clearings as small as ¼-acre in size. Sites half this size sometimes are used, especially if surrounded by low brush. You can divide large fields into smaller areas by planting hedgerows and clumps of shrubs. This will encourage several woodcock to use the same field. When planting, remember that seedlings may need protection from gnawing rodents and browsing deer to become well established. Place a cylinder of ¼-inch wire mesh around each seedling if this becomes a problem. Bury the end 6 inches underground to stop burrowing rodents. Also remember that existing vegetation is easier to manage than planting new vegetation.

Beaver

This semi-aquatic rodent may weigh as much as 60 pounds. It is the only wild animal that noticeably changes the environment to suit its needs. It cuts large and small trees, builds dams to impound water, and digs canals for transportation. Central to these activities is the construction of a mounded lodge or a streambank den. The entire complex is referred to as a beaver flowage.

One lodge will house a family of beavers, including young of the current year and young of the previous year. Adults mate in February and young are born in May. By June the kits are foraging around the water's edge, acclimating to a diet of succulent plants including grasses and weeds. They remain with the family for two winters. At this time, coincidental with sexual maturity, they leave the lodge to establish a colony of their own. Female beavers bear their first young during the spring of their third year and average about four kits per litter annually.

Adult beavers may shift upstream or downstream in their quest for food. They will even travel overland to a new drainage area. Two-year-olds strike out on their own and colonize new areas. A new flowage is home for one or two beavers, seldom more. Trapping during the first year, before these beavers have a chance to reproduce, can eliminate these residents.

Colonizing beavers can change the character of a small valley. Stretching upstream behind a low dam, a new beaver flowage represents a new wildland community. As a result of the dam and felled or dying trees, small openings fill with sun-loving plants or water. This habitat is inviting to many species of wildlife. Mink, raccoons, and green herons search for frogs and other prey along marshy edges. Dead trees harbor insects that, in turn, are fed upon by woodpeckers. Large woodpecker holes are potential nesting sites for a variety of cavity-nesting birds. Some species of birds like the wood duck, alder flycatcher, and Louisiana waterthrush are

closely tied to this semi-aquatic habitat. Here they find nesting and brooding sites, and quiet rest stops during migration. Initially, brook trout may benefit from the extra water and nutrients provided by beaver activity. But as the dam site ages, sun warms the shallow water, silt accumulates, and fewer trout will find the habitat suitable.

A stream bordered by thin-barked trees such as aspen, birch, and red maple is attractive to beavers. The presence of low brushy alder and willow also is desirable because of the ability of these species to resprout after they are cut by beavers. Resprouting provides a sustained source of food.

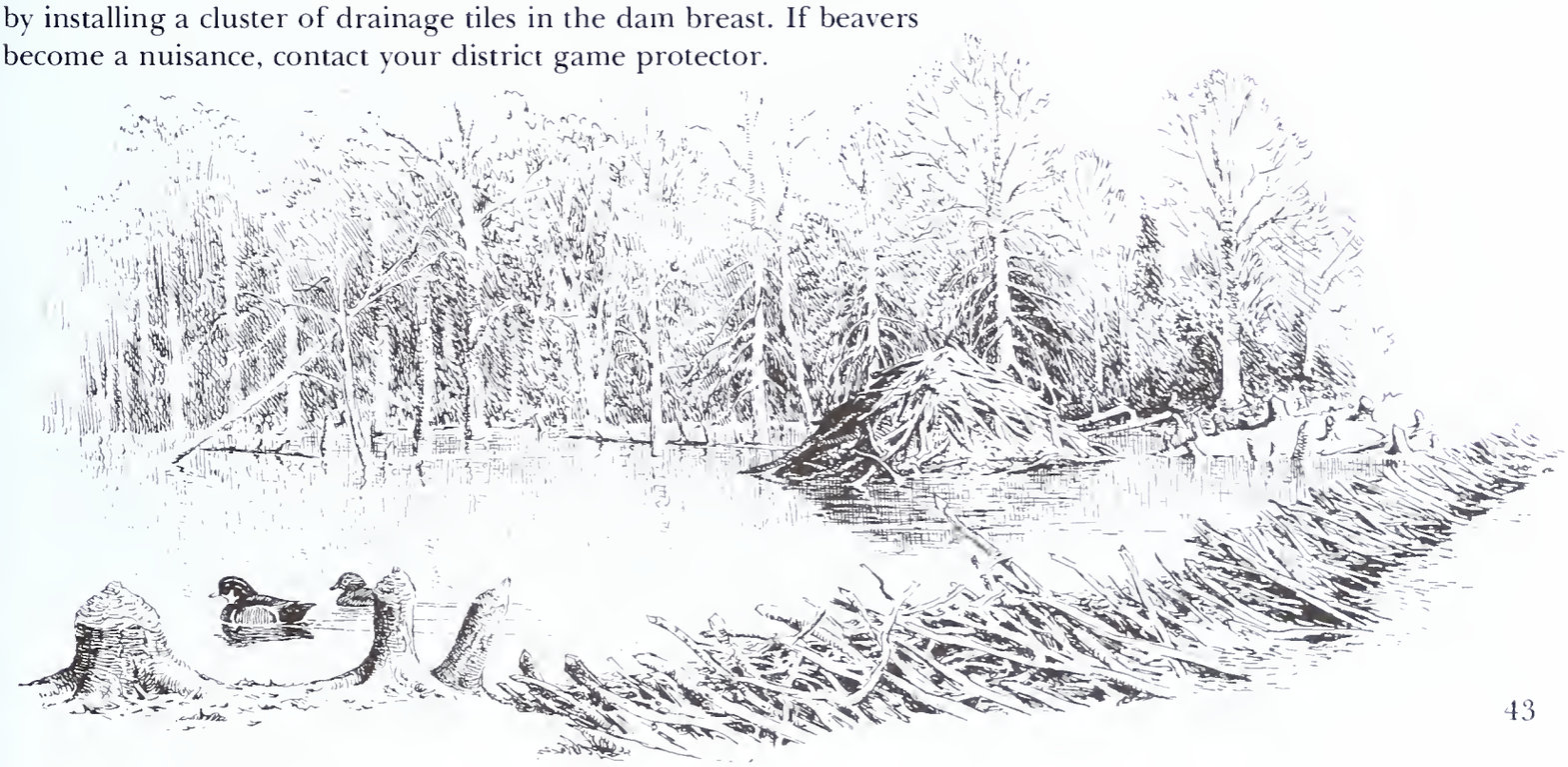
It is not feasible to try growing more woody food plants in the presence of beavers. But up or downstream, beyond the zone of beaver influence, you could plant willow cuttings and seed alder in sunlit meadows. Basket and purple-osier willow cuttings are suitable. Fresh cuttings of the previous year's growth (about half-an-inch in diameter) with the cut end forced into damp soil well below the summer waterline, will yield best results. Fall-collected alder seed should be sown in February and March at the rate of one-half pint per 100 square feet on moist sites.

Beavers readily eat maple and aspen that is brought to the vicinity of their lodge. One small, fresh-cut aspen sapling one inch in diameter is ample for a night's food supply for each adult beaver.

Given too much protection, beavers will multiply and quickly exhaust their food supply. This can happen within two or three years if there is less than 200 yards of suitable beaver habitat. Trapping beavers is desirable to prolong the suitability of the habitat. Complete removal of beavers may be justified to give cut trees and brush a chance to regenerate from sprouts.

But beavers can be a nuisance. Common complaints include: blocked drainage culverts, flooded roads and croplands, cut shade trees, and blocked and silted trout streams. Careful consideration should precede attempts to establish beavers in unoccupied habitat.

A 5-foot-high fence dug about 1 foot into the soil will protect valuable trees and shrubbery from beavers. Unwanted flooding can be controlled by installing a cluster of drainage tiles in the dam breast. If beavers become a nuisance, contact your district game protector.



Furbearers

Furbearers such as fox, raccoon, opossum, skunk, mink, and weasel are found in a variety of rural settings. They inhabit both forest and farmland, often traveling back and forth between open and tree-covered habitats. Common haunts include fencerows, woodlot edges, swamps, streamsides, abandoned fields, and old logging roads. Usually active at night, furbearers may traverse many properties.

These animals have numerous common traits. For instance, vacant woodchuck burrows may be at least temporarily preempted by any of these species. Crevices between boulders, brush piles, and holes under tree stumps are homes for furbearers, too. These sites may be used a few hours for refuge or for longer periods as nurseries where young are born and raised.

Most births occur during the first two months of spring. Depending on the species, from two to ten young survive to leave the den. You're in luck if you find a den full of red fox pups. Their playful antics and practice stalks can provide hours of entertainment.

These wide ranging species eat a wide variety of foods. Small birds, eggs, mice, crayfish, frogs, insects, carrion, corn, nuts, and berries serve as food when available. In essence, they are opportunistic feeders eating whatever is easy to catch or find. By preying on rodents, culling weak and diseased animals from prey populations, and scavenging carrion, they perform a valuable function in a wildland community. This, together with their monetary value as furbearers, makes them a welcome addition to forested acres.

Whether it's a family of raccoons in the sweet corn or the proverbial weasel in the hen house, certain troublesome individuals demand attention. Fencing to exclude furbearing predators is seldom practical. It is possible to remove offending animals by trapping or shooting, providing you comply with wildlife regulations.

If in doubt about methods or regulations, call an experienced trapper or your local game protector for advice or help. During winter a trapper will welcome such a request. Prime fur from these species is a valuable, renewable resource; one that requires less energy for conversion to a saleable product than many synthetic substitutes.

Generally speaking, if your property contains suitable types of food and cover for a variety of other animals, it will also attract and support some furbearers.

Woodlots bounded by old fields can be improved by removing some of the trees along the woodlot's edge and planting wildlife-food shrubs along this same edge. The result will be a brushy woodlot border of a width somewhat equal to the height of adjacent, uncut trees. This situation favors insects, rodents, and berries that, in turn, attract fox, raccoon, opossum, skunk, and weasel.

Brushy clearcut areas that are intersected by grassy weed-covered logging roads provide good ground cover that supports large rodent populations. Fox and raccoon droppings, regularly deposited on such logging roads, provide evidence that these furbearers are attracted to such habitat.

Mink, muskrats, and occasionally other furbearers find suitable habitat at stream banks, marshes, and beaver flowages. Shrubs and brushy cover

enhance these wetland habitats.

Brushy fencerows with vine tangles and rock jumbles are valuable wildlife habitat. Furbearers prefer the food and cover provided by such travel lanes. Fencerows offer natural paths to different habitat types. Where the only brushy corridors of food and cover abutt highways, road kills of furbearers result. Undisturbed fencerows develop naturally. Many species of wildlife, especially furbearers, benefit when fencerows are located away from hardtop roads and are 15 feet or more wide.

Small Mammals

At least 64 kinds of wild mammals live in Pennsylvania. Cottontails, squirrels, deer, and a few furbearers are discussed elsewhere. Bats, moles, shrews, and rodents are introduced here. Treatment of these forms is brief, designed to generally acquaint you with their place in the forest. Some of these species will be familiar to you, others may require identification.

Variety alone shows mammals are interesting inhabitants of woodland communities. If you own only one wooded acre, it's safe to say that at least three different kinds of mammals are living there and contributing to the scheme of things. These permanent residents include shrews (those tiny mammals with the small eyes and pointed noses), white-footed mice, and chipmunks. Bats, squirrels, and cottontails will visit the same acre at one time or another. Such variety can be interesting, but it is quantity that lends importance to small mammals. When it comes to being fruitful and multiplying, some of them excel. Prolific mammals are beneficial if they eat insects, but a nuisance if they eat grain. Management of some species consists of getting rid of them, rather than attracting them.

With the exception of the bats, most small mammals can subsist year-round on an acre or two. Their home range often is less than an acre. Most of them, especially the shrews, are relatively short-lived, rarely surviving a second winter. Lowest populations of small mammals occur in February and early March (immediately before young are born). Highest numbers, frequently over 100 per acre, occur in September and October. Sometimes, for unknown reasons, increases in births and deaths occur, accentuating the highs and lows.

Shrews are obscure mammals rarely popping above the dead leaves covering the forest floor. These diminutive denizens of the leaf layer eat large quantities of invertebrates. Snails, spiders, insects, worms, and overwintering larvae and grubs are regularly devoured. In turn, shrews are eaten by furbearers, hawks, owls, and snakes. Domestic cats regularly deposit them, uneaten, on the back porch. Potentially large numbers, diet, and use by other larger predators make shrews desirable neighbors. An untidy woodlot floor with a thick layer of leaf litter and rotting logs is inviting to shrews. A layer of herbaceous vegetation, such as that found in a forest clearing or old field, is suitable habitat. Here, shrews can find an abundant supply of insects to satisfy their appetite.

The moles' world consists of an underground network of shallow and deep tunnels. These small mammals conduct a year-round search for earthworms, snails, spiders, insects, larvae, and even carrion. Vegetable matter is only an incidental part of their diet.

Topography and soils with earthworms dictate where moles are found. Surface cover is not so important since they rarely venture above the surface. Where woodcock abound, moles will be found, as both species are attracted by soils with large populations of earthworms. Moles provide a service by producing runways for other small mammals and by eating slugs, grubs, and insect larvae. Plants may die, however, as a result of a mole's excavating activities, although the incidental burying of seed may be compensatory. When moles become objectionable in cemeteries, golf courses, lawns, and turf, they can be controlled. Moles are welcome in wooded areas and swamps.

Bats are an important part of biological control and help prevent insect outbreaks and damage. Some kinds of bats are loners, others reside in colonies. On their nocturnal feeding flights bats consume insects on the wing. With the advent of cold weather (when flying insects become scarce) bats hibernate or migrate. They hibernate in caves, crevices, buildings, hollow trees, or beneath bark slabs. Different kinds of bats have different preferences for winter housing. Three tree bats — red, silver-haired, and hoary — migrate south and then return the following spring.

The chipmunk, active during daylight hours, is one of the most visible and widespread of all woodland mammals. Open woodlands with logs, stumps, and clumps of undergrowth; stonewalls, dividing field and forest; and ornamental ground covers and rock gardens adjacent to suburban lawns are good places to look for chippies. Chipmunks hibernate during the winter in underground nests that can be as big as a basketball. Young are born in these nests.

Chipmunks eat a variety of foods including seeds, berries, fungi, snails, salamanders, small snakes, and invertebrates. They may feed in vegetable gardens and flowerbeds. They also may steal eggs from bird nests. Their omnivorous habit, and their ability to store food and hibernate, allows them to spend most of their life within 50 to 100 feet of where they were born. You can encourage chipmunks by felling a few trees here and there. Hawks, foxes, bobcats, weasels, and other day-time predators regularly eat chipmunks.

Woodchucks prefer hay fields, pastures, cropland margins, fencerows, and orchards. Grassy roadsides forming corridors of suitable habitat result in woodchucks inhabiting woodlands that normally would not be so attractive to them.

New herbaceous growth is the woodchuck's primary food. Weed shoots, grass, clover, new leaves, and garden vegetables assure the woodchuck a plentiful supply of food. Like chipmunks, chucks are hibernators, spending much of November through February deep in an underground burrow. Woodchucks can be real pests in farmed areas, although they are not so objectionable in woodland clearings. In fact, the woodchuck is an inadvertent ally of many other kinds of wildlife that readily use old woodchuck burrows for refuge, notably the cottontail rabbit, opossum, and skunk. Planting grass on recently retired logging roads, seeding cutback roadside, and maintaining herbaceous clearings will benefit woodchucks.

White-footed mice, like so many small mammals, are secretive and seldom noticed even though they are common and abundant throughout the woodlands. White-footed mice may be found in open fields, in damp

forests, around mountaintop bogs, in cabins, or in any woodland habitat where some overhead cover is present. These mice eat small seeds, berries, snails, insects, and even carrion. In turn, they are a food staple for foxes, weasels, snakes, hawks, and owls. The prevalence of white-footed mice serves to buffer the impact of predators on other wildlife species. When foxes and other meat-eaters are devoting their time to catching and filling up on readily available mice, they can't be chasing and eating game animals such as young grouse. Mice provide still another service when they eat insects.

Deer mice are fun to watch and conveniently lend themselves to educational projects. A bird box installed on a tree or fence post along a woodland margin will attract a mouse as easily as a bird. Young will be raised in these houses and mice will overwinter in them. In late February those mice unclaimed by predators can be evicted. Clean the house out and it's ready for cavity-nesting birds, if the same mouse is not around to reclaim it.

The wood rat, unlike alien domestic rats, is a native mammal with a furry tail. Shunning low altitudes and developed areas, the wood rat prefers rocky outcrops on mountainsides, sandstone rock slides, and dry ledges. It does not hibernate but will store plant food for winter. Its diet consists of fruits, berries, new green shoots of any plant, and fungi. Wood rats are food for bobcats and other predators, but their nocturnal habits make them especially vulnerable to great horned owls. If your property contains the Eastern wood rat's typical habitat, look for storage piles of berries, grass, and litter on rocky shelves or cave floors. These food stores mark its presence.

Voles are specialized rodents that most of us call mice. Their young, which are born in spring, can be grandparents by fall. Few voles ever reach the ripe old age of one year. Meadow voles and pine voles are found in fields, while cool hemlock ravines with moss-covered rocks are the home of rock voles. And scattered throughout northeastern hardwood forest and bog habitats are the red-backed voles. The reproductive potential of the vole, particularly the field dwellers, makes them an important group of small mammals. They graze on succulent vegetation and gnaw the bark of woody plants. Their diet includes garden vegetables, grasses, weeds, seeds (cherry, beechnuts, acorns), berries, fungi, roots, bark, and even bones. Voles are active under snow where they feed on green or dried plant materials, natural hay, rootlets, and bark.

Damage in cultivated areas, orchards, tree farms, and nurseries can be substantial when vole populations are high. Fortunately, voles are readily consumed by almost every carnivorous bird, mammal, and snake big enough to eat them. Like white-footed mice, voles are a buffer between predators and other animals.

Forests with openings which stimulate low herbaceous cover support more voles than woodlands without low herbaceous cover on the forest floor. Within the woodland they rarely create serious problems, but in orchards, nurseries, and plantations it may be necessary to control them with rodenticides.

Woodland and meadow jumping mice hibernate for about 6 months. This habit somewhat compensates for their reckless jumping and constant

exposure when they are active. Hawks by day and owls by night — virtually every predator — will prey upon these wayward mice. Their life-span is usually less than a year.

Small, swampy forest clearings interspersed with log jumbles will attract the woodland jumping mouse. So, too, will recent cutovers where strips of trees are left along a cold mountain stream. Dense upland forests with moss-covered tangles of fallen logs and cool mountain bogs are attractive to these mice. Small seeds, berries, and a host of smaller herbs are the mainstay of a woodland jumper's diet. Insects also are eaten.

Porcupines are exclusively woodland mammals and rarely wander far from trees. Surprisingly, they eat a wide variety of herbaceous plants. During winter they climb trees — hemlock, cherry, maple, beech, and aspen — and subsist on a diet of inner bark.

One young per year is produced. This contrasts sharply with the high productivity of most rodents. Predation losses are low since few meat-eaters include porkies in their diet. As a result, porcupines have a potential life-span of 12 years. Clearcuts with grassy openings, piles of slash, and rapidly-growing thin-barked trees are especially attractive to porcupines, especially if these sites are near or include rock jumbles, small cliffs, ledges, and large hollow trees.

Around a cabin or the edge of a tree plantation, porcupine damage may cause serious losses. Trapping and shooting will reduce their numbers. Sheet metal around the base of cabins prevents porcupines from climbing and gnawing on the structures.

Muskrats are valuable furbearers that provide many people with income. The smallest creek or pond is home for the muskrat. In woodlands, muskrats may be sparse. Look for them in wooded swamps and beaver flowages where the roots and stems of aquatic plants such as cattails, rushes, and other aquatic plants provide food.

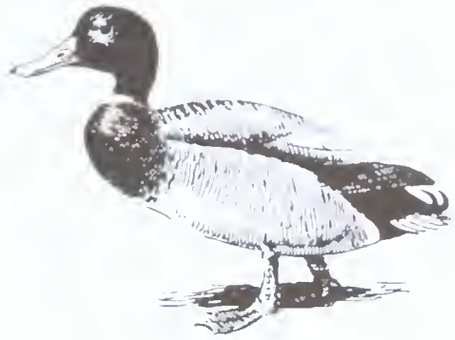
Wetlands management will benefit muskrats. Three essentials are required to maintain a muskrat population: (1) there must be an abundance of sunlit openings with lush aquatic vegetation for food and cover; (2) there should be a reliable source of fresh water for travel and sanitation; and (3) there should be clay soil which is conducive to digging of burrows, canals, and runways. A mix of 80 percent vegetation and 20 percent open water is good. Deep water sites (at least 36 inches deep) or springs that don't freeze over insure their survival in winter. Sedge, bullrush, and cattail roots can be planted in shallow water during spring months. These species provide food, cover, and house-building material. Willow and alder plantings also offer cover. Burrowing muskrats can frustrate attempts to maintain dikes. When such construction is planned, consider a core of cinder blocks or concrete to prevent muskrats from digging through the breastwork.

Waterfowl

Only a few species of waterfowl nest in appreciable numbers in Pennsylvania, even though nearly all species of North American ducks, geese, and swans may be represented in fall and spring migrations. Mallards, black ducks, and wood ducks are the main species you may

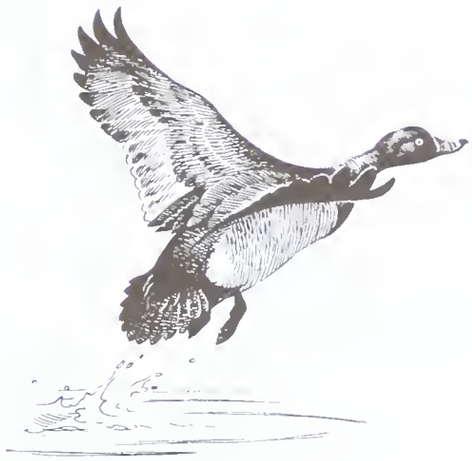
attract and manage on your property.

You can create waterfowl habitat by developing shallow marshes, building woodland ponds, or dredging to expose water that lies near the surface. A visit to observe waterfowl management on public marshes such as Buzzard Swamp in the Allegheny National Forest, Middle Creek Waterfowl Area in Lebanon County, Erie National Wildlife Refuge in Crawford County, or Seigel Marsh in Erie County will help you to make plans for your property. The points to consider for large impoundments are: state permits, engineering design, heavy-equipment costs, skill, and experience in management.



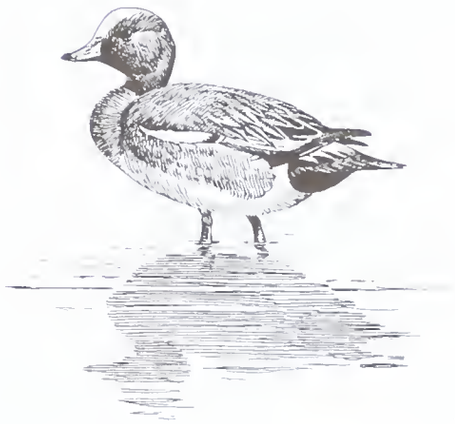
Small marshes require low dikes and water control structures that impound several acres of water, most of which should be 1-foot to 2-feet deep. A water control device permits you to raise and lower water levels. If water levels can be lowered by mid-July, plant Japanese millet on the exposed mud flats of the marsh. Broadcast about 20 pounds of seed to the acre and use a drag to cover the seed. When you raise the water level in the fall, the mature millet seed will be available to migrating ducks that stop. Oak woodlands adjacent to the marsh will provide ducks with some food and cover. Oak trees can tolerate flooding from mid-September to December, but you should lower the water following migration to avoid killing the trees.

Nearly all farm ponds attract waterfowl during spring and fall migrations. However, farm ponds usually do not make good duck nesting habitat unless they are specially located in areas remote from human activity and built with shallow margins which encourage aquatic plant growth. Ducks are attracted to pond margins where emergent aquatic plants grow. They especially like plants such as bulrush, pickerelweed, arrowhead, and burreed — plants which often detract from other pond uses. Some aquatic plants such as waterlily, spatterdock, watermilfoil, and bladderwort are of little value to waterfowl. If your pond has a potential for nesting waterfowl, you should permit growth of aquatic plants and bank vegetation. Ungrazed grasses and weeds provide cover around the pond that is favorable to duck nesting sites.



Establishing aquatic plants by planting or seeding is complex and difficult. Most attempts are unsuccessful. You must use care in choosing plants or seeds because of variation in sites and plant requirements. Fall planting is best, whether you use seeds, tubers, or entire plants collected from other aquatic areas.

The scarcity of hollow trees often prevents wood ducks from living in otherwise suitable habitat. Wood duck habitat usually has equal parts of open water, emergent aquatic plants, and woody cover including some mature trees. You should save large mature trees that grow along stream bottoms or at the edges of lakes or ponds. Species that are adapted to moist sites and which are most likely to develop natural cavities include: sycamore, red maple, black gum, willows, and some oaks. Wood ducks need a 4-inch diameter entry hole and a 10-inch diameter nest cavity so look for trees 14- to 16-inch in diameter as potential nest sites.



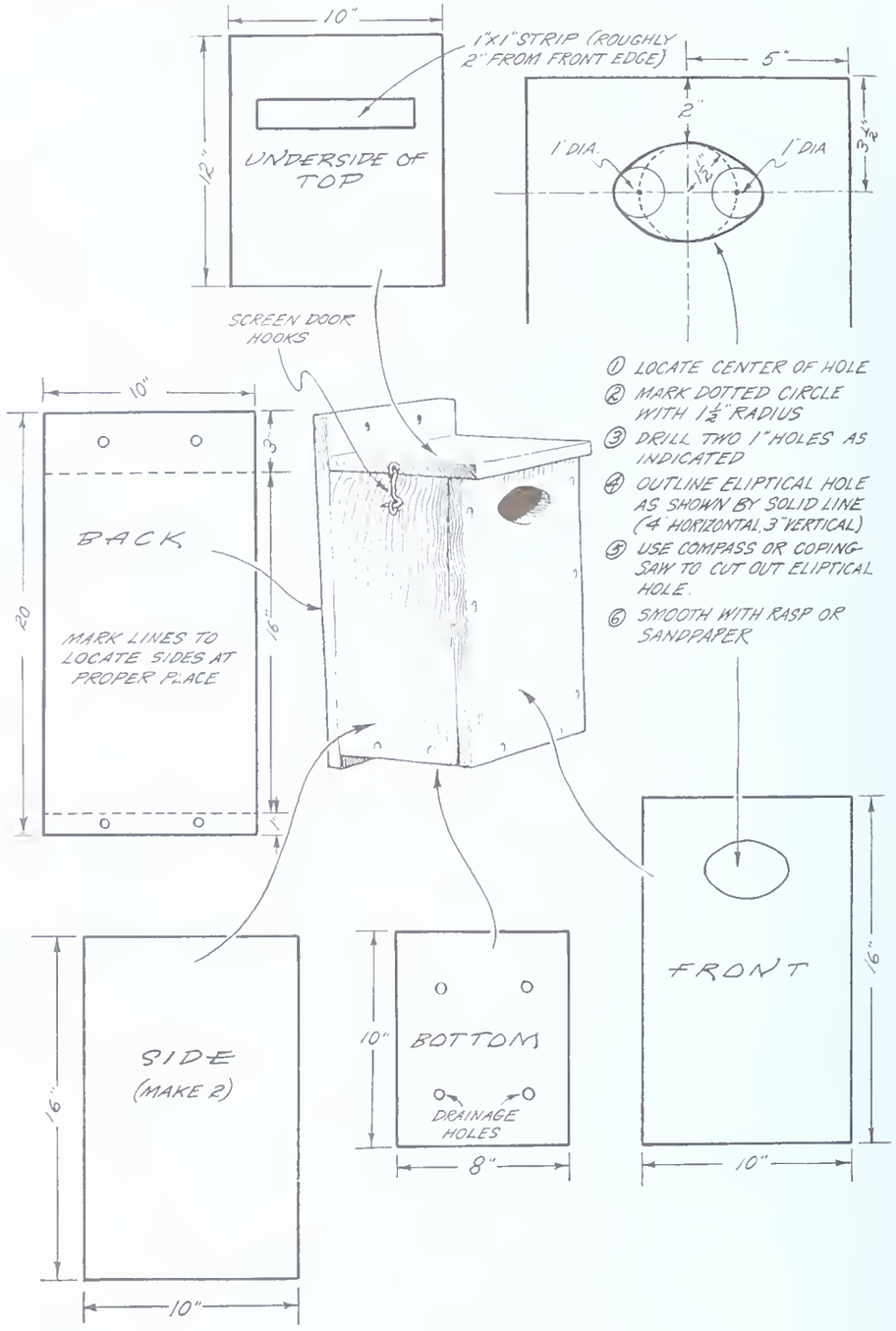
Artificial nest boxes can substitute as wood duck nest cavities. Boxes of wood and metal are acceptable to wood ducks. Construct wooden boxes using the plans of the universal nest box illustrated on page 50. Metal boxes may last longer but they need special fabrication. Nest predation

Universal Nest Box for Wood Ducks, Squirrels, Screech Owls, and Sparrow Hawks

Materials

1 piece	1 x 10 x 20 inches	— back
3 pieces	1 x 10 x 16 inches	— front and sides
1 piece	1 x 10 x 12 inches	— top
1 piece	1 x 10 x 8 inches	— bottom
1 piece	1 x 1 x 8 inches	— strip inside top

20 8-penny galvanized or alumnium nails
4 lath nails for strip inside top
2 screen-door hooks and eyes to attach top



Directions for Assembly

1. An 8-foot board, rough cut 1 x 10 inches, is enough for each box. Select well-seasoned, air-dried, white oak which will withstand years of weathering. Use rough sawn, unplaned wood. Cut pieces to size.

2. Cut the hole. For wood ducks cut an elliptical hole according to the diagram. For screech owls and sparrow hawks cut a 3-inch round hole in the front. For squirrels cut a 3-inch round hole on one side near the back. Top edge of the hole should be 2 inches from the top of the front or side. Tack a 3-inch strip of window screen from hole to bottom of box to enable young wood ducks to climb out.

3. Drill several ¼-inch holes in the bottom for drainage.

4. Drill ¼-inch holes at the top and bottom of back piece to erect the box.

5. Nail strip on underside of the top.

6. Drill ⅛-inch holes for all 8-penny nails to facilitate nailing in oak.

7. Install screen-door hooks to hold top securely.

can be minimized by the use of metal cones or guards on trees and posts. Mount boxes on posts at a height of 4 to 5 feet above water or 15 to 45 feet high on trees. Place several boxes in a group rather than singly, then add groups at 100-feet intervals as the boxes are occupied. Place the boxes so that the entrances are visible to the wood ducks. Put 3 to 5 inches of wood shavings in each box and replace this nesting litter each winter. Have your boxes up by March 1 so they are available when the first wood ducks return to seek nest sites.

Nest structures constructed as cylinders, about 12 inches in diameter and 36 inches long, and erected horizontally attract both wood ducks and mallards. The materials may be 12-inch diameter furnace pipe or heavy-gauge mesh wire covered with graveled roofing paper. For wood ducks these cylinders should have wooden ends: one with an elliptical entrance hole and the other end partially open at the top to allow light in the box (to discourage starlings from nesting). For mallards, build the cylinders of chicken wire. Roll and fasten a 3-foot-by-3-foot piece to make a cylinder. Lay a 4-foot-by-3-foot piece flat and cover with 3 to 4 inches of long hay. Roll the second piece, with hay, around the first (inside) cylinder and fasten. Mount the assembled cylinder between stakes with cross bars to support the nest about 12 inches above the water surface. Face the cylinders at right angles to the prevailing winds. Wild mallards may be more reluctant to use darkened nest structures than mallards that have been propagated and released.

Songbirds

Songbirds are part of any outdoor experience. They add color, action, and pleasing song to your enjoyment of the forest. In Pennsylvania the state list includes nearly 400 bird species. Although not all of these occur in the forest, there are many forest birds and you can expect different kinds to visit your property. They will stay if they find suitable food, cover, and water, or an appropriate nesting site. Different habitats attract different kinds of birds.

Each species of bird has its favorite place for feeding and nesting, and each has a preference for certain foods. Some birds such as the junco, Carolina wren, catbird, cardinal, and towhee spend their time on the ground or in the underbrush. These species thrive in a young forest. Others, such as the nuthatches and the brown creeper, search tree trunks to find insects in the bark crevices. Woodpeckers peck deep into the wood of trees, seeking insects to eat. Treetop birds such as the kinglets, oriole, scarlet tanager, and red-eyed vireo feed among the high limbs and twigs.

Forests that contain both young and old stands, those that have a variety of tree and shrub species, and forests with some open herbaceous areas provide habitats needed to encourage a rich variety of birdlife. The more diverse your property, the more diverse your bird population is likely to be. Not all the habitat types that we'll discuss are necessary to attract birds.

Old trees, both dead and living, are an important component of your woodland. Old trees are ideal spots for woodpeckers to search for insects, and they may provide cavities for a nesting nuthatch or screech owl. Large trees provide high nesting sites for birds such as the blackburnian warbler and scarlet tanager and produce seeds eaten by a variety of species. Trees

that produce small light seeds, such as cherry, birch, and maple, are more important to songbirds than heavy-seeded species such as hickory or oak. Old trees should be scattered throughout your woodland. Four or five trees per acre are good, more are better. Suggestions for managing old stands of trees can be found in the section on Mature Woodlands.

Brush is important to attract some species of songbirds to woodlands. Many birds nest in low, brushy vegetation only a few feet off the ground. Brushy thickets provide escape from predators. Many shrubs produce abundant small fruits, a favorite food of many birds.

PLANT A 3- OR 4- ROW SHRUB BORDER AROUND EVERGREEN STANDS AND MULTIFLORA "LIVING FENCES" AROUND PASTURES.

Brushy borders can be established along woodland edges, woods roads, and trails. This can be done by cutting all trees that are taller than 10 feet in a 25-foot-wide border.

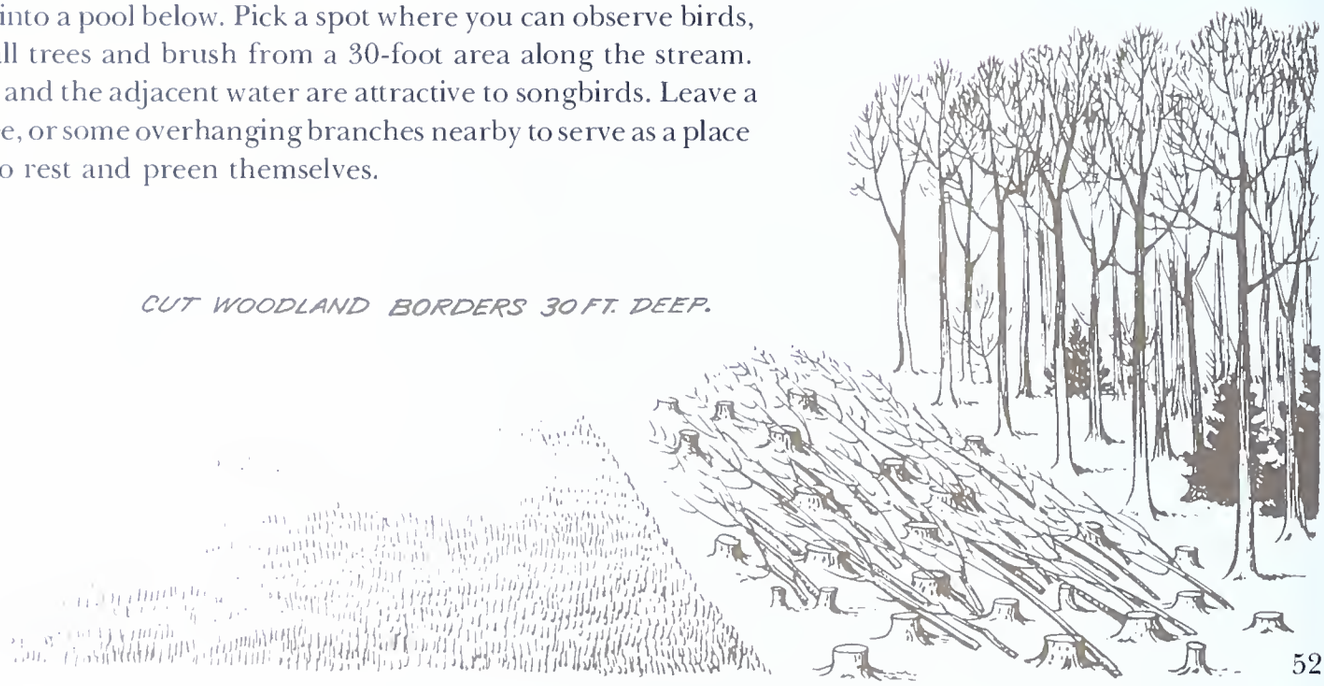
Planting clumps of shrubs in open fields will provide food and escape cover that will encourage songbirds to use these areas. High densities of birds nest in fencerows and shrub clumps from which they seek insects in the adjacent fields.

Conifers help to attract birdlife to your area. Plant clumps of conifers, such as pines and spruces, to provide shelter during the winter and escape cover all year round. Some songbirds, such as prairie warblers and kinglets, nest primarily in conifers.

You'll want to have numerous small herbaceous areas scattered throughout your woodland. These areas can be a rich source of food for birds. The leafy herbaceous material is an important food for many species. You can manage some of the areas for annuals such as ragweed and smartweed, as discussed in the section on Herbaceous Openings. Herbaceous plants provide an abundance of food for seed-eating birds. In addition, herbaceous areas are rich in insect life which attracts such insectivorous birds as flycatchers and swallows. Perhaps of more importance, protein-rich insects are essential to the growth of most young birds.

If your property has a stream, you have an ideal place to attract birds. Birds need water for drinking and bathing and are strongly attracted to moving and dripping water. In a riffle area, use rocks to create a small falls so water drips into a pool below. Pick a spot where you can observe birds, then remove all trees and brush from a 30-foot area along the stream. Such clearings and the adjacent water are attractive to songbirds. Leave a fence, dead tree, or some overhanging branches nearby to serve as a place for the birds to rest and preen themselves.

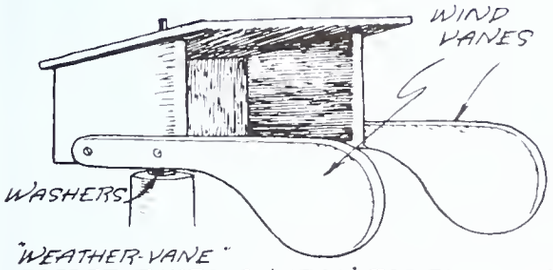
CUT WOODLAND BORDERS 30 FT. DEEP.



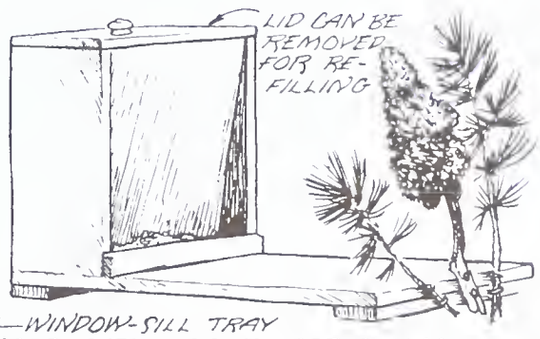
Many people want to attract birds to their backyards and window feeders. Creating diverse habitats adjacent to your home will greatly enhance any effort you make in your backyard. Birds can be attracted to the smallest of backyards. How you attract them is limited only by your imagination. Start by erecting a feeder, one of the quickest techniques for attracting birds. Enclosed or hopper-type feeders that keep the seeds dry are desirable. Face your feeder away from the prevailing winds and locate it in a spot so you can observe the birds. Remember that once you begin feeding birds they'll rely on you for a source of food, so keep your feeder full throughout the winter months. Commercial bird feed is available from farm, garden, and grocery stores. Small grains such as cracked corn, wheat, millet, sorghum, and sunflower seeds can be used to formulate your own bird feed mix. Suet chunks that attract woodpeckers, bluejays, and nuthatches can be offered in wire baskets fastened to trees. Starlings are fond of suet and may become a nuisance around your feeder.

Water attracts birds so you should include this method in your backyard plans. Bird baths should have rough bottoms and sloping sides and be less than 3 inches deep. Your bird bath is even more attractive when you hang a bucket so that water will drip into the bird bath. Hang the bucket off to the side with a tube extending out over the water. These feeding and watering facilities will attract birds for short visits during part of the year.

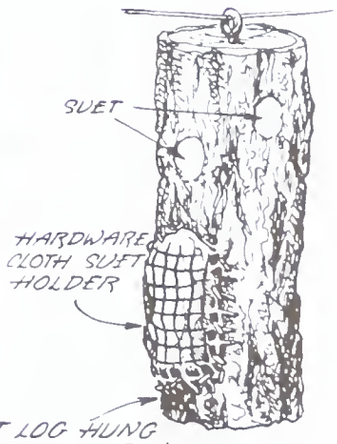
If you want birds to reside in your yard you must have the proper habitat. This requires planting a variety of trees and shrubs. Several rules will help you to get the most from your plantings. Most important is to choose trees and shrubs of different heights. This will help to attract the greatest diversity of nesting species. Be sure to plant several evergreens. Spruce provides tall cover while rhododendron and holly are shorter and also provide good year-round cover. Be sure to plant at least one evergreen near your feeder to help protect birds from the wind and to provide year-round escape cover.



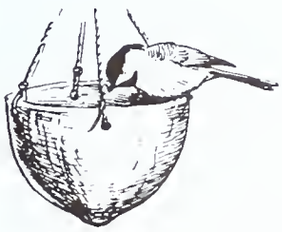
"WEATHER-VANE" FEEDER PIVOTS ON IRON ROD TO KEEP OPEN SIDE DOWNWIND.



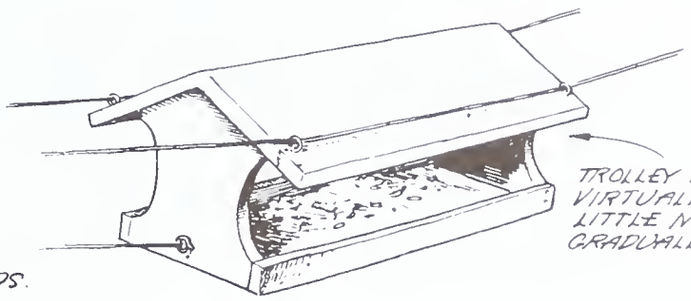
ABOVE—WINDOW-SILL TRAY FEATURES AUTOMATIC FEEDER, SUMAC SEED HEAD & PINE BOUGHS



SHORT LOG HUNG ON WIRE MAKES NATURAL FEEDER. PACK 1" HOLES WITH SUET.



COCOANUT SHELL FOR SEEDS.

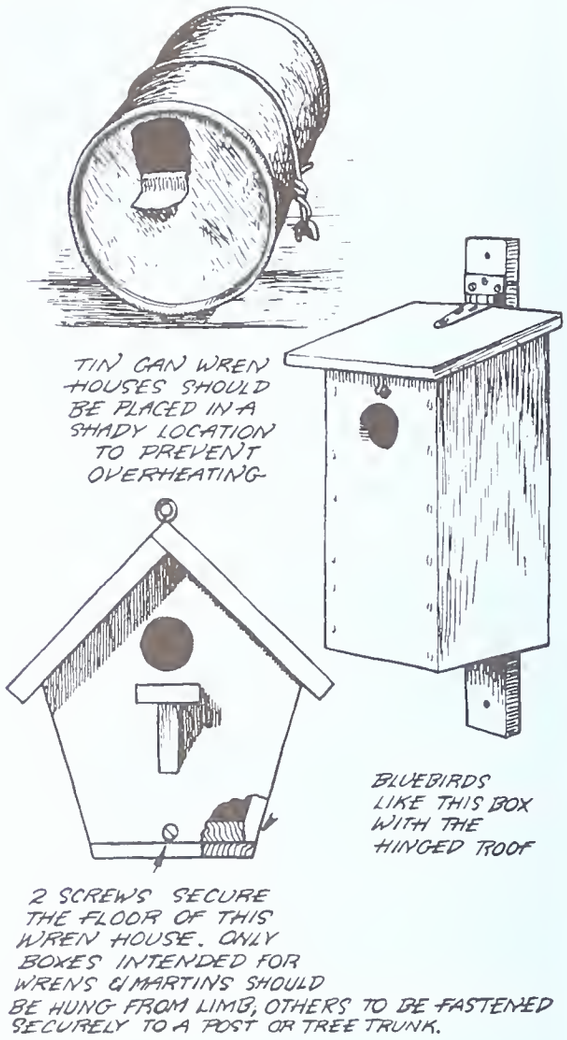


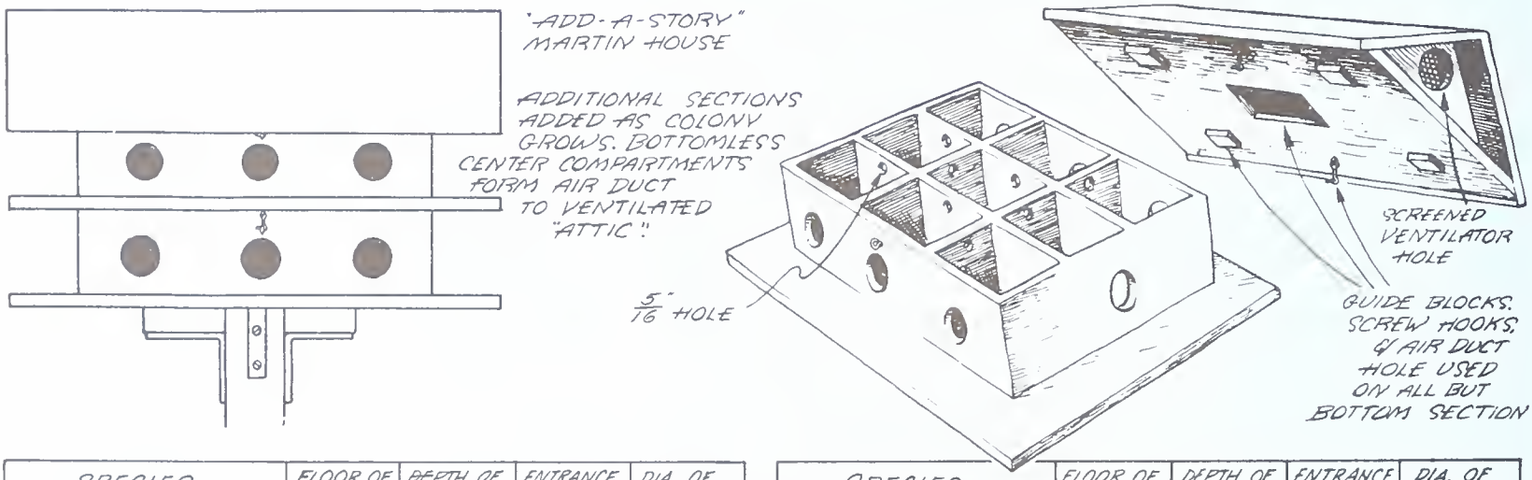
TROLLEY FEEDER, SUSPENDED ON WIRES, IS VIRTUALLY CAT-PROOF. BY DRAWING IT A LITTLE NEARER EACH DAY BIRDS CAN BE GRADUALLY COAXED RIGHT UP TO THE HOUSE

You should plant trees and shrubs that flower and fruit during various times of the spring, summer, and early fall. For example, flowering dogwood blooms between April and May, blackberry and autumn olive flower from May to July, hawthorn in June, and elderberry in June or July. Blackberry is the first to provide fruit, beginning July and lasting until September. Elderberry provides fruit during August and September and flowering dogwood from August through November. Autumn olive fruits in September, with fruit remaining on the shrub as late as December, providing food during the early winter months. Hawthorn fruit of certain species persists as late as March. Washington hawthorn is particularly good because of its regular fruiting.

You can attract birds during the nesting season by providing natural nesting sites such as trees, shrubs, hedges, and thickets. The planting suggestions discussed here will provide good natural nesting cover. Nest boxes attract some of the cavity-nesting species such as house wrens, blue birds, chickadees, and purple martins. Nesting boxes are an effective way of increasing the number of resident birds in your backyard or woodlot. When erecting nesting boxes, place the entrance hole away from the direction of prevailing summer winds. Furnish birds with a variety of nesting materials such as string, yarn, excelsior, pieces of soft cloth, and dried grass during the nesting season (May through August). Place the materials in a box to prevent the wind from scattering them over your yard.

One final touch would be to create a dusting area for birds. Birds take dust baths to kill insect parasites in their feathers. You'll find it's an interesting activity to observe. Spade an area 2 feet by 3 feet in a sunny corner of your yard. Expose the soil and keep it fine, loose, and free of vegetation.





SPECIES	FLOOR OF CAVITY	DEPTH OF CAVITY	ENTRANCE ABOVE FLOOR	DIA. OF ENTRANCE
BLUEBIRD	5"x5"	8"	6"	1½"
CHICKADEE	4"x4"	8-10"	6-8"	1⅛"
TITMOUSE	4"x4"	8-10	6-8"	1¼"
NUTHATCHES	4"x4"	8-10	6-8"	1¼"
HOUSE WREN	4"x4"	6-8"	1-6"	⅞"
CAROLINA WREN	4"x4"	6-8"	1-6"	1⅛"
CRESTED FLYCATCHER	6"x6"	8-10"	6-8"	2"

SPECIES	FLOOR OF CAVITY	DEPTH OF CAVITY	ENTRANCE ABOVE FLOOR	DIA. OF ENTRANCE
FLICKER	7x7"	16-18"	14-16"	2½"
RED-HEADED WOODPECKER	6x6"	12-15"	9-12"	2"
DOWNY WOODPECKER	4"x4"	8-10"	6-8"	1¼"
PURPLE MARTIN	6"x6"	6"	1"	2½"
TREE SWALLOW	5x5"	6"	1-5"	1½"
BARN OWL	10"x18	15-18"	4"	6"
SPARROW HAWK	8x8"	12-15"	9-12"	3"

Hawks and Owls

Hawks and owls are probably the least understood members of the forest wildlife community. Subtle and almost incidental techniques can be employed to attract them, but don't expect to see great numbers.

Consider birds of prey in your wildlife planning. As a group these avian predators represent efficient and stately links in the natural food chain. From time to time smaller birds and mammals, which you have attracted or produced on your property, will serve as food for these hawks and owls. This contributes to the stability of your wildlife community.

Most hawks are included in two groups: the accipiters or woodland hawks such as goshawk, Cooper's hawk, and sharp-shinned hawk; and the buteos or soaring hawks such as red-tailed hawk, red-shouldered hawk, and broad-winged hawk. Identifying characteristics of these and other hawks can be found in any good bird guide.

Raptors (birds of prey) prefer to nest in tall deciduous trees, from which they can keep watch over a wide area. Some hawks and owls may nest in conifers, but evergreens usually supply them with escape cover. Three species, sparrow hawks (Kestrels), screech owls, and saw-whet owls, are cavity nesters.

Preserving large trees, living and dead, in open areas is important. These hunting and resting perches frequently are used by resident and transient hawks. You may want to consider girdling a tree next to a clearing to provide such a perch. Choose a tree that has strong horizontal branches. In addition, nesting boxes along edges of fencerows will be used by sparrow hawks that prey on small rodents and large insects. Nesting boxes also can be used for screech owls; large wooden or wicker baskets, attached adjacent to the trunk 20 or more feet from the ground, will attract the larger owls.

Woodland clearings and old fields next to your woodlot are valuable to hawks and owls. Low vegetation, both herbaceous and woody, supplies food for small rodent populations. Small rodents make up the bulk of the avian predators' diet, hence the value of a woodland clearing to these birds of prey.

Owls provide a mystic and secretive element to your woodland property. These nocturnal predators are seldom seen, but often heard by the attentive listener. Hooting of the great horned owl — hoo, hoohoo, hoo, hoo — in December and January is as seasonal and sure as the dogwood blossoms in April. Our earliest nester, the great horned owl, begins incubating in January. Barred owls, whose calls are more numerous and higher pitched, are nicknamed the "eight-hooter." The call is a series of eight accented hoots — hoohoo-hoohoo . . . hoohoo-hoohooaw — and sounds like "Who cooks for you? Who cooks for you-all?" The eerie song of the long-eared owl sounds like a baby crying in the distance.

Another common nighttime sound is the quavering whistle of the screech owl, which is likely to reside in a small woodlot. The screech owl will respond to a rough imitation of its call, and with some patience you may be able to call it towards you.

The saw-whet owl, whose call is a long series of saw-like whistles, is our smallest owl.

Den trees are an important attraction for owls. Some of these dens may

be used for many years. The larger barred owls and great horned owls will use the crotch of hardwoods for nesting sites, whereas the smaller saw-whets and screech owls are cavity nesters. Conifers provide valuable cover for all owls, and you may want to consider establishing a plantation. Strips or clumps of white pine, Norway spruce, red cedar, or similar vegetation will add owl habitat to your property. Obviously time and patience are required for you to see, or hear, the results.

If you have a little-used or abandoned shed or barn on your property, you may have an excellent nesting site for barn or "monkey-faced" owls. Some ornithologists feel that the removal of many barns is having a serious detrimental effect on the species.

Hawks and owls belong in your neighborhood wildlife scheme. You won't soon forget a flash of color from a red-tailed hawk or the silhouette of a great horned owl on a moonlit night.

Farm Wildlife and the Forest

You may wish to pursue some form of wildlife management even though you own a large amount of agricultural land along with forest land. In this case you will find it advantageous to direct some management efforts toward farm wildlife species.

Many animals such as rabbits, pheasants, and a variety of songbirds find agricultural lands best suited to their needs for food and cover. Nevertheless, most farm wildlife will use forest land to satisfy some daily or seasonal needs, especially in winter when most crop fields are barren.

Brushy woodland borders and fencerows adjacent to crop fields are especially attractive to farm wildlife. Low shrubby vegetation provides nesting sites for songbirds and protects them against predators and harsh weather. Insectivorous birds nest along fields, forage in the adjacent crops, and provide definite benefits in insect control.

Woodchucks often prefer to dig their burrows along woodland borders, and cottontail rabbits frequently take refuge in these burrows. Management of woodland borders can enhance their wildlife values and reduce competition between trees and field crops.

Trends in land use today commit agricultural lands to two widely divergent fates, neither of which is especially beneficial to farm wildlife: (1) intensive agriculture with monocultures, or (2) abandonment which eliminates either food or cover required by farm wildlife. Where agricultural practices permit the continued existence of farm wildlife, managed woodlands and woodland borders play a vital role.

Cottontail Rabbit

The cottontail is Pennsylvania's number one game animal. The eastern cottontail is the most common species and is a small dark rabbit weighing 2½ to 3 pounds. Its color varies from dark grayish buff to rusty brown with the nape and legs a rich cinnamon brown. Underneath, the cottontail is whitish, including the underside of the tail.

Cottontails begin breeding in early spring and continue through the summer. Many females produce five litters in a single season; four and five young per litter. Females usually breed again almost immediately after bearing young.

Young cottontails are blind, naked, and helpless at birth but mature rapidly and may leave the nest permanently when 14 to 16 days old. Nesting cover may be open grassy areas such as fields, orchards, brushy pastures, lawns, fencerows, and flower beds. The nest is a depression in the ground lined with grasses or leaves and fur and is covered with a mat of leaves and grasses. Heavy rains may flood nests and drown young cottontails. Wet weather, predation, and human disturbance all take their toll. By August in any given year, survival of the young may be only 20 percent or less.

Cottontail rabbits can survive in a variety of habitats, but the highest population densities are associated with reverting farmland, newly-cut wooded areas, and young conifer plantations.

Cutting of woodland borders — where fields and woodlands meet — provides both food and cover for cottontails. Width of the cutting (from field edge back into the woodland) can vary from 25 to 50 feet. Tops and limbs of cut trees should be left in place or piled to provide immediate wildlife cover. Sprouting of trees and shrubs and invasion by herbaceous plants will provide both food and cover in subsequent years. As tree and shrub sprouts grow, use of the border for food and cover will decline. To renew brushy cover and stimulate new sprouting, borders should be recut every 5 to 10 years.

During the summer months, succulent greens are important foods, especially for young rabbits. Food strips may be established by cultivating, fertilizing, and planting with grasses or clovers. Food strips also may be established by mowing 10-foot-wide strips of natural weeds and grasses. Strips should be mowed as often as is necessary to maintain low succulent vegetation. These mowed food strips, either planted or natural, should be located adjacent to brushy cover. In areas where ringnecked pheasants may nest, mowing can be postponed until hatching is largely completed, about the third week of June.

Hedgerows of shrubs may be planted to provide food and cover. Three or more rows will be needed since single rows provide little cover for wildlife. Spacing between rows varies, for example from 2 feet for coralberry to 6 to 8 feet for autumn olive, depending on the growth habit of the shrubs. Multiflora rose is a good species for such plantings, although its tendency to spread rapidly and to resist control efforts make it objectionable to many landowners. Hedgerows should be cut periodically on a rotating basis to maintain optimum food and cover values. Frequency of cuttings varies among shrub species. As shrubs grow and lose their cover value, cutting will stimulate sprouting, thereby providing low cover and food for cottontails. Mowing adjacent to hedgerows provides succulent summer food.

Conifer plantings provide excellent cottontail cover. Block plantings 50 feet by 50 feet work well, although conifers may be planted in rows as indicated for shrubs. Recommended spacing varies from 4 feet by 4 feet up to 10 feet by 10 feet. Close spacing will provide cover sooner, but trees need thinning when lower branches on adjacent trees touch and shade herbaceous vegetation on the ground. Wider spacing permits mowing between rows. Mowing eliminates invading trees and shrubs and provides the succulent vegetation cottontails prefer for food. Conifer plantings lose their value for cottontail cover after the crowns form a solid canopy

that shades the ground underneath and inhibits growth of herbaceous vegetation. If you anticipate having little time for thinning conifer plantations, wider spacing is desirable.

Brush piles provide excellent cover but should be considered as supplements to other rabbit cover. Brush piles cannot substitute for growing cover such as brush and weeds. For instance, a single brush pile placed in the middle of an open pasture has little value. Several of them built in abandoned fields having a good growth of weeds or along the edges of woodland provide supplemental escape cover and winter cover for rabbits. Created in ringneck country, brush piles often become havens for wiley roosters during hunting season. Piles should be 10 to 15 feet in diameter, approximately 5 feet high, and constructed over a core of logs or large branches which create ground-level openings for rabbits. Brush deteriorates with age and should be replaced periodically. Limbs and stems (obtained by border cuttings and by annual maintenance of roads and trails) will have greater value if they are piled rather than scattered over the ground.

Apple trees and blackberry patches should be maintained. Natural hedgerows and fencerows should be retained and managed in the same manner as border cuttings. Reverting fields can be retained in the field stage by mowing or disking.

The cottontail's range may be as little as ¼ acre or as much as 10 acres, depending upon the availability of food and cover. Food and cover should be well interspersed. Food patches and nesting areas should occur as close as possible to good escape cover to reduce the exposure of rabbits to predators.

A good plan for a 5-acre area includes four or five ¼-acre patches of dense brush, briars, conifers, or vines for escape cover; four or five ¼-acre patches of planted or natural grasses, left unmowed, near brushy cover for nesting; and several patches of tall perennial weeds for late fall and winter food and cover. Several long, narrow food patches also may be established unless fields of grasses or clover are being cultivated adjacent to escape cover or winter cover.

Ring-necked Pheasant

Ring-necked pheasants, first stocked in 1915, are now well established in intensively farmed sections of the Commonwealth. Male ring-necks have multi-colored iridescent plumage with the characteristic white ring around the neck. Females are mottled brown. Weight of adult birds ranges from 2 to 3½ pounds. Males are slightly larger than females.

The pheasant's breeding season extends from April to June. Hay fields are preferred nesting sites with legume hay fields selected over grass hay fields. Winter grain fields, fencerows, orchards, and idle areas provide alternate nesting sites. When early nesting attempts fail, the hen often renests, but clutch size usually diminishes with renesting attempts. Mortality of young birds is high, usually 50 percent and often greater than 80 percent.

Insects are important food items in the diet of young pheasants. Cultivated grains, weed seeds, and assorted leafy greens increase in importance as pheasants mature. Corn, ragweed, wheat, foxtail,

smartweed, oats, and buckwheat are common foods in Pennsylvania.

Ideal pheasant range is composed of approximately 70 percent cropland and 30 percent brush, marsh, and woodland. Crops evenly divided between hay, small grains, and corn are best.

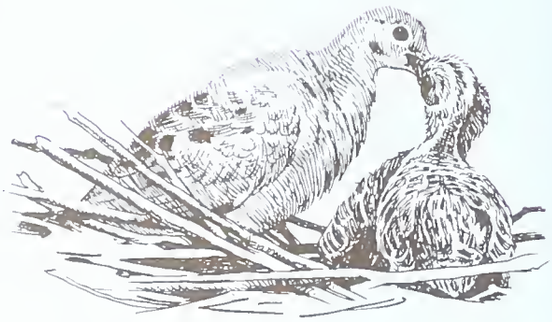
Intensive agricultural practices may have to be modified to manage pheasants. Since many hens nest in hay fields, early cutting of hay destroys nests and may kill or cripple birds. On farms managed for pheasants, you should postpone mowing until the third week in June to increase hatching success and decrease hen mortality. It is essential to maintain and develop brushy cover in fencerows and gullies, and along streambanks. Save wet meadows with blueflag and cattail cover. Woodland habitat is important. You can establish evergreen cover by planting conifers (1 to 3 acres). In winter pheasants roost mostly in trees instead of in low, dense cover used at other seasons. Corn should be left standing adjacent to all types of roosting cover. Where food is lacking, several rows of corn underplanted with soybeans provide a good food strip for pheasants. All these management suggestions involve special food and cover development to meet the needs of pheasants.

Mourning Dove

Mourning doves are migratory birds, although some doves may spend the winter on your property. Pairs or small groups often congregate along roads, driveways, and backyard feeders. Here they pick up grit scattered on the ground, which is needed for digestion of seeds and waste grain. Their feet are not adapted for scratching. A showy, white-margined tail and whistling takeoff are identifying marks of mourning doves.

By late March the mournful cooing of male doves signals the onset of breeding. Doves are prolific, monogamous nesters. Most pairs attempt 3 to 5 nests between April and August. Each nesting attempt takes about a month to complete; incubation of the two eggs requires about 2 weeks, and rearing of the young, until they can fend for themselves, takes 2 weeks. Once the nestlings are fledged, or leave the nest, the adults begin a new cycle within a few days. Nests frequently are found next to the trunk of a conifer about 10 feet from the ground. There are exceptions, and nests may be found in crotches of deciduous trees, in honeysuckle thickets, or on the ground.

Mourning doves do not use the deep woods; instead, they use areas having fencerows, orchards, cultivated and abandoned fields, woodland borders, and conifer stands. If crop fields are near your property, cover may be the only thing you need to attract doves onto your property. However, planting corn at wide-row intervals and interseeding between rows with grasses and legumes also attracts doves.



By planting evergreens you will encourage a local nesting or roosting population. Norway spruce, white pine, red cedar, scotch pine, Virginia pine, Japanese larch, and hemlock are favorite nesting sites. Rows or clumps of these trees are more effective than single plants. Nesting pairs seem to prefer trees whose lower branches droop to the ground rather than those trimmed in a park-like fashion. This additional ground cover favors other wildlife as well. Pines, larch, and red cedar require 8 to 10 years before they are suitable for use as nesting sites. Spruce grows more

slowly and takes 15 to 20 years before it is suitable for nesting.

It may be beneficial to provide a bare site where grit, minerals, and dust will provide an important attraction for this and other kinds of birds using your property.

Although doves may alternate nest sites during the nesting season, you may be able to determine their nesting success throughout the season. Whether your observations are casual or discriminating, this species will yield much personal satisfaction.

Bobwhite Quail

The bobwhite quail is a small game bird that prefers open herbaceous areas for nesting and brushland for escape cover. Since Pennsylvania marks the northern limit of the bobwhite's range, the birds are found regularly only in some of the southern counties and occasionally are found in small isolated populations elsewhere.

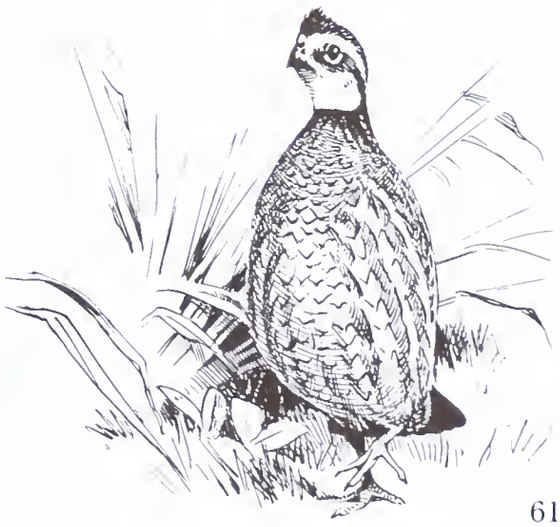
Bobwhites nest on the ground in herbaceous cover such as fallow fields, hay fields, grain fields, grassy orchards, and herbaceous forest openings. Their nests are frequently found along hedgerows, streams, and woodland borders. Nesting begins in April or May.

Weather is the most significant mortality factor for quail. Young are lost in heavy spring rains, and adult coveys are lost in severe winter weather. Mammalian predators such as skunks, opossums, and raccoons have their most significant effect on nests and eggs.

The daily movement of bobwhites is relatively limited. The birds seldom move more than ¼ mile per day if all their food and cover requirements are found within this distance.

Ideal range for the bobwhites consists of equal portions of cultivated crops, ungrazed grasslands, brushland, and woodland. Cultivated crops provide valuable nesting cover and foods such as corn, sorghum, wheat, buckwheat, and clover. Use of herbicides in corn fields reduces the value of such fields to quail since weeds that provide both cover and food are eliminated. Ungrazed grasslands, such as fallow or reverting fields, provide nesting cover and foods such as ragweed, foxtail, beggarweed, and wild sweet pea. Thickets of honeysuckle, blackberry, multiflora rose, raspberries, and similar shrubs permit bobwhites to escape predators and to endure severe winter weather.

In natural quail range, several steps can be taken to improve habitat. Development of cover lanes is achieved by planting rows of shrubs in large fields and by leaving 15-foot, unmowed strips along woods borders. These lanes encourage the birds to nest and allow them to move about without being exposed to predators.



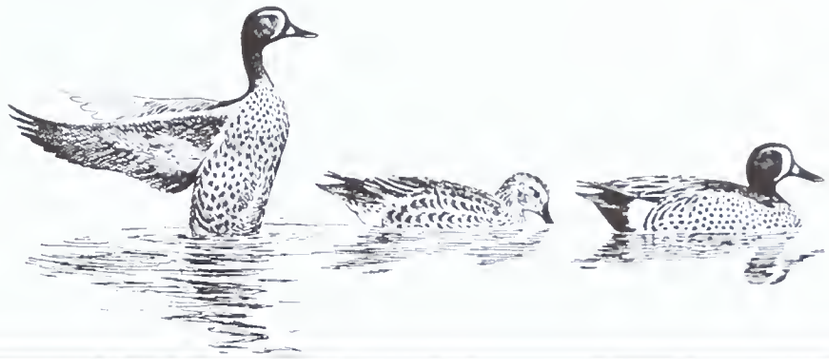
Bobwhites make best use of food located near escape and winter cover. Food for quail is provided by patches of corn, wheat, oats, buckwheat, sorghum, millet, rye, and clover. Food plots are most easily provided by leaving a small corner or a few rows of crops unharvested, especially those crops close to winter cover. Where possible, native food-producing plants should be encouraged. Woodlands should be thinned heavily for quail to allow food and cover plants to develop in the understory. The canopy should be opened so that at least 60 percent of the forest floor is exposed

to sunlight. Grazing of woodlands should be prevented to increase quail benefits.

Dense clumps of evergreens provide winter cover so essential to overwinter survival of bobwhite coveys. Adequate winter coverts can be developed from thickets of shrubs, vines, and herbaceous vegetation.

Remember to insure interspersion of the quail's food and cover needs by providing all requirements within ¼ mile or less.

Attempts to establish quail where they do not exist (stocking with pen-reared birds) seldom are successful and usually are quite expensive. This practice is not recommended.



Trails to Wildlife

Trails offer an opportunity to bring you together with the wildlife found on your property. A well-planned hiking trail can provide easy, quiet access to a variety of sites on your property so that you may observe without intruding on your wildlife neighbors.

Your wildlife viewing trail should have a well-defined starting point such as a building, cabin, or a place where cars are parked. For your convenience, the trail should begin and end in the same general location by forming a loop. You may wish to incorporate a long and a short trail into two loops or a figure-eight design for variety.

Your trail should have numerous curves and bends to add the element of surprise so that there will be a greater opportunity to flush a grouse or rout a deer. Straight stretches of trail are monotonous and should not exceed 100 feet.

Careful consideration should be given to the wind direction when laying out your trail. Some wildlife species, particularly deer, will not be observed if they detect human scent. Local winds on your property may be

different from the prevailing (westerly) winds. As a general rule in mountainous terrain, the wind movement is up slope in the mornings and down slope in the evenings. So, to observe deer in an old apple orchard, be sure to approach the orchard from a crosswind or upwind direction, so that your scent will not frighten the deer before you have an opportunity to observe them.

Your trail should connect points of interest and pass through or near areas of major wildlife activity. In addition, trails should wind through a variety of cover types. Grouse are likely to be flushed near conifer plantings in winter, and deer use clearcuts for browsing. Swamps and wet areas often are key centers of activity for all forms of wildlife. If your property contains such a site, be sure your trail passes near it.

Wildlife viewing blinds along trails can be an effective aid in observing wildlife. Blinds often can be used effectively in conjunction with wildlife plantings, food plots, or clumps of preferred shrubs so you may observe your wildlife neighbors without disturbing them. Your blind should be large enough for comfort and permit limited movement without detection.

You may find it convenient to use old woods roads and logging roads on your property for part of a trail. Some new construction may be necessary to connect existing trails. In general, hand tools such as shovels, mattocks, and axes are adequate for most foot trail construction.

Where soil has been displaced, there may be danger of soil erosion. You should use erosion control measures such as seeding grasses and directing water off of the trail. Good drainage is a prerequisite for a well-constructed trail. Often a log set at an angle across a steep portion of trail can serve as a step and also divert water from the trail.

A narrow unobtrusive trail constructed for your own use requires little maintenance beyond an occasional clearing of brush and does not present as many problems as developed, group-type hiking trails.

If your trail is to be used by large groups such as school classes or outdoor groups, it may be desirable to plan a more elaborate trail.

Beyond This Primer

Since, in these few pages many topics have been only highlighted, we include the following references and additional readings.

You can obtain additional help in the form of publications, financial aid, or consulting services from federal, state, county, and private agencies. If you haven't already done so, get in touch with the nearest Soil Conservation Service office, and Cooperative Extension Service office. Personnel of these offices can help you with free literature, planning assistance, and soils information. They also can refer you to other sources of aid.

Under the Cooperative Forest Management Program, a state-employed service forester can, at your request, provide you with a management plan. Objectives of the plan can improve your forest habitat for wildlife or help you integrate wildlife considerations into other types of assistance, such as timber marking and tree planting. Consulting foresters provide management services for larger woodlands. Contact the district forester or the Bureau of Forestry for specific information.

State agencies responsible for administering, managing, and protecting wildlife usually are excellent contacts. All provide helpful publications; some furnish wildlife food shrubs and planting assistance. For specific information contact your district game protector of the Pennsylvania Game Commission.

Some forest owners will want further information on managing their forests for wildlife. Many publications are available from local libraries, or the books can be purchased in book stores and from publishers.

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